

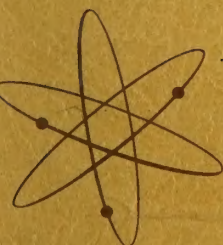
PRICE \$2.00

# HEATHKIT<sup>®</sup> ASSEMBLY MANUAL

HEATHKIT<sup>®</sup> by DAYSTROM

2-METER TRANSCEIVER  
THE "TWOER"

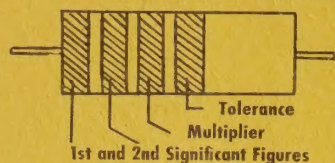
MODEL HW-30



# STANDARD COLOR CODE — RESISTORS AND CAPACITORS

## AXIAL LEAD RESISTOR

Brown — Insulated  
Black — Non-insulated



Wire wound resistors have  
1st digit band double width

INSULATED  
UNINSULATED  
Color

BLACK  
BROWN  
RED  
ORANGE  
YELLOW  
GREEN  
BLUE  
VIOLET  
GRAY  
WHITE

FIRST RING  
BODY COLOR  
First Figure

0  
1  
2  
3  
4  
5  
6  
7  
8  
9

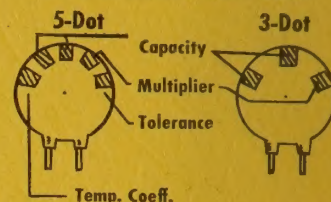
SECOND RING  
END COLOR  
Second Figure

0  
1  
2  
3  
4  
5  
6  
7  
8  
9

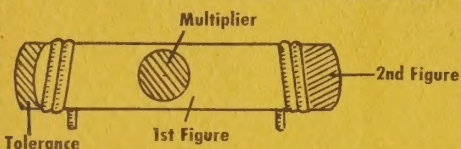
THIRD RING  
DOT COLOR  
Multiplier

None  
0  
00  
0,000  
0,000  
00,000  
000,000  
0,000,000  
00,000,000  
000,000,000

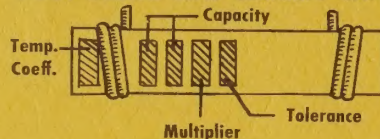
## DISC CERAMIC RMA CODE



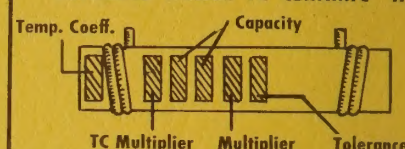
## RADIAL LEAD DOT RESISTOR



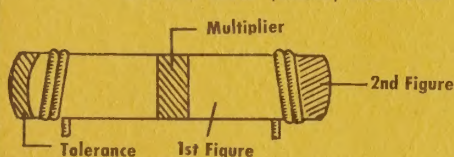
## 5-DOT RADIAL LEAD CERAMIC CAPACITOR



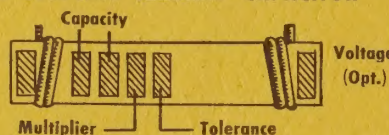
## EXTENDED RANGE TC CERAMIC HICAP



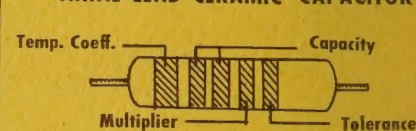
## RADIAL LEAD (BAND) RESISTOR



## BY-PASS COUPLING CERAMIC CAPACITOR



## AXIAL LEAD CERAMIC CAPACITOR



The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are 1/2 watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors 1/2 watt, 1 or 2 watt may be color coded but the first band will be double width.

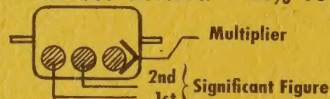
## MOLDED MICA TYPE CAPACITORS

### CURRENT STANDARD CODE

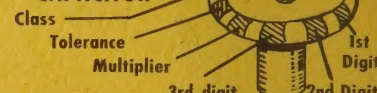


JAN &  
1948  
RMA  
CODE

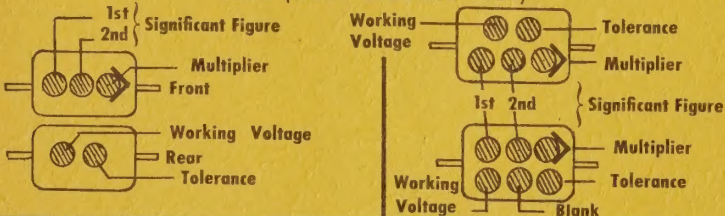
### RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.



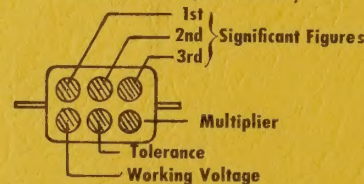
### BUTTON SILVER MICA CAPACITOR



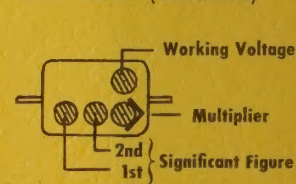
### RMA (5-DOT OBSOLETE CODE)



### RMA 6-DOT (OBSOLETE)

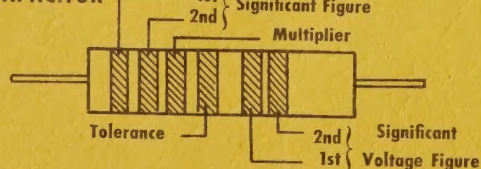


### RMA 4-DOT (OBSOLETE)



## MOLDED PAPER TYPE CAPACITORS

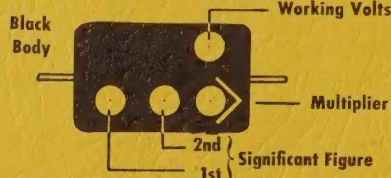
### TUBULAR CAPACITOR



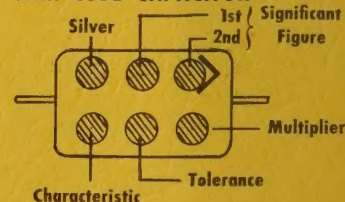
Normally  
stamped for  
value

### MOLDED FLAT CAPACITOR

Commercial Code Working Volts



### JAN. CODE CAPACITOR



A 2 digit voltage rating indicates more than 900 V.  
Add 2 zeros to end of 2 digit number.

The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Assembly  
and  
Operation  
of the

**HEATHKIT®**  
**2-METER**  
**TRANSCEIVER**  
**THE "TWOER"**  
**MODEL HW-30**



HEATH COMPANY,  
BENTON HARBOR,  
MICHIGAN

**DAYSTROM, INCORPORATED**  
a subsidiary of

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\*Fold-out from page listed.

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

## SPECIFICATIONS

TRANSMITTER SECTION

Power Input To Final RF Amplifier: . . . . .	Approximately 5 watts.
Frequency Control: . . . . .	8 mc to 8.22 mc quartz crystal. Pin spacing .500". Pin diameter .093". FT-241 or FT-243 crystal holder.
Modulation: . . . . .	AM plate modulation, automatically limited to not more than 100%.
Output Impedance: . . . . .	50 or 72 $\Omega$ .

RECEIVER SECTION

Receiver Type: . . . . .	Superregenerative detector preceded by RF pre-amplifier stage.
Sensitivity: . . . . .	Usable with signals as low as 1 microvolt at the antenna terminals.
Speaker Size: . . . . .	3-1/2" round.
Audio Power Output: . . . . .	Approximately 1 watt (undistorted).
Tuning Range: . . . . .	143.0 mc to 149.0 mc.

POWER SUPPLY

Power Rectifier: . . . . .	Two silicon diodes in full-wave voltage doubler circuit.
Power Requirements: . . . . .	With built-in supply: 105-125 volts 50/60 cycle AC 45 watts.  With external supply: 6 volt operation - 6 volts at 2.35 amps, 260 volts DC at 90 ma. 12 volt operation - 12 volts at 1.2 amps, 260 volts DC at 90 ma.

ACCESSORIES

Microphone: . . . . .	Ceramic element type, plastic case. Suitable for either hand or desk operation.
Connecting Cables: . . . . .	Two supplied, one for 105-125 volt AC operation and one for 6 or 12 volt external DC power supply use. Power circuits are automatically switched for internal or external power supply use when cable is plugged in.

GENERAL

Tube Complement: . . . . .	1 - 6BA8: Oscillator/Tripler (Pentode Section) Tripler (Triode Section)
	1 - 6BA8: Doubler (Triode Section) Final RF Amplifier (Pentode Section)
	1 - 6BS8: Receiver Preamplifier and Detector.
	1 - 12AX7: Speech Amplifier and First Audio Amplifier.
	1 - 6AQ5: Audio Output and Modulator
Cabinet Dimensions: . . . . .	8" high (including handle). 6" deep (including knobs). 9-3/4" wide (including license holder).
Net Weight: . . . . .	6-1/2 lbs.
Shipping Weight: . . . . .	10 lbs.

~~~~~

Minor variations from these specifications may be encountered in kit-assembled equipment. Such factors as exact lead placement, component variations and normal variations in tube characteristics are possible sources of deviations. Such variables will ordinarily have no significant effect on overall performance.

## INTRODUCTION

The HEATHKIT Model HW-30 Transceiver is a combination transmitter and receiver for use in the 2-meter amateur radiotelephone service.

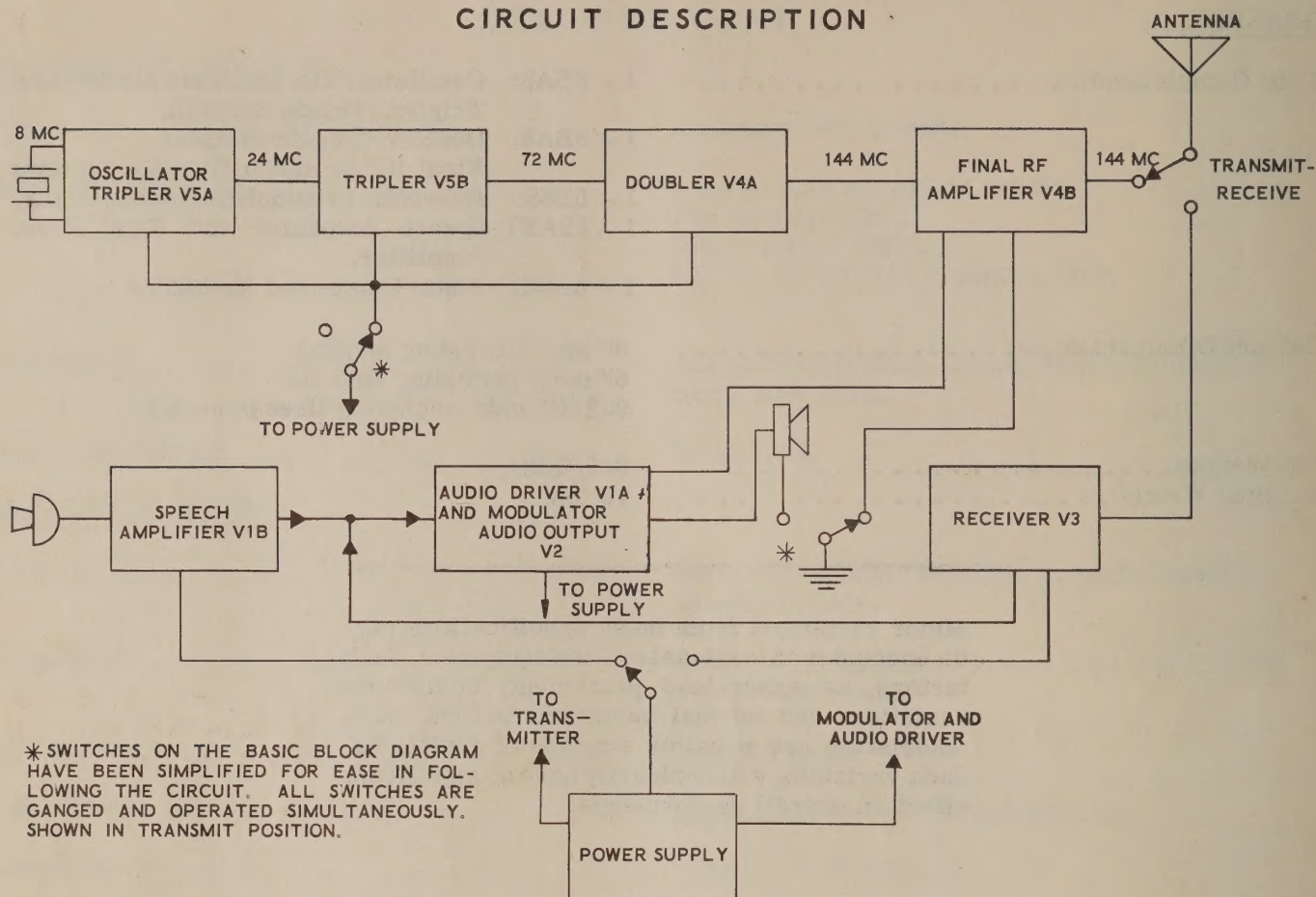
Extensive proofbuilding and field testing over a period of several months have provided conclusive evidence that the HW-30 Transceiver will provide highly reliable service in its intended application, if assembled, wired and adjusted in accordance with the instructions outlined in this manual. It is, therefore, recommended that you follow the instructions carefully and make full use of the Circuit Description, Block Diagrams, Schematic Diagram, Installation Information, etc., in the

interest of acquiring a good understanding of the transceiver and its capabilities.

The HW-30 Transceiver has a self-contained power supply for operation from a 117 volt 50/60 cycle AC power line, or can be operated from either a 6 volt or a 12 volt battery by using an external power supply having a rating of 260 volts B+ at 90 ma.

The HW-30 can be used with a wide variety of antenna types; an antenna should be selected for the transceiver on the basis of the application involved. See Page 37 for a discussion of suitable antenna types.

## CIRCUIT DESCRIPTION



## TRANSMITTER SECTION

The basic signal from which the final transmitter output is obtained (8 mc) is generated at 1/18 of the final output frequency in tube section V5A. This circuit is crystal controlled providing excellent frequency stability and is known as an "electron coupled" Pierce oscillator. "Three times" frequency multiplication is obtained in the plate circuit by tuning the output to 24 mc. This signal is coupled to the following stage through C6.

Tube section V5B multiplies the 24 mc signal again by three, providing a 72 mc signal which is coupled to the following stage through C8. Stage V4A is a frequency doubler which provides an output at 144 mc to drive the final amplifier grid.

V4B is the final amplifier and operates "straight through;" i.e., the input and output circuits are tuned to the same frequency. RF output is coupled to the antenna, through C17 and the transmit-receive switch contact, from a tap

approximately 1/2 turn from the "cold" end of the final tank coil L4. The actual tap point is not critical and can be adjusted for optimum coupling if deemed necessary. Since most antenna feed lines will be in the vicinity of 50-75 ohms, the suggested tap point will provide near optimum coupling for most typical situations.

At the rear antenna terminal, there is provided a rather unique power output detector circuit consisting of diode D1, resistor R8 and capacitor C18 and C19. This system, used in conjunction with an external voltmeter, supplies a convenient means of tuning the final tank circuit for maximum power into the antenna transmission line. As the power consumed by this device is negligible, the meter may be left in the circuit at all times to indicate proper operation of the transmitter. The meter jack for this purpose is a three circuit standard phone jack and the reading is made with the plug inserted approximately halfway into the jack, such that the tip of the meter plug contacts only the first terminal in the jack.

If the metering plug is inserted all the way into the jack, the meter will read final amplifier cathode current, typically in the order of 20-25 ma. The meter plug must be withdrawn from this position for normal operation once proper tuneup has been accomplished. The meter plug in this fully inserted position overrides the normal functioning of the transmit-receive switch and allows final amplifier plate current to flow regardless of switch position.

With a key plug inserted all the way in the meter jack, the transmitter may be used on CW if desired, although considerable "back wave" may result due to the fact that previous transmitter stages are running constantly.

For phone operation, modulation is accomplished by causing the plate and screen voltage source for V4B to vary at the audio frequency rate determined by the signal being passed through the combination modulation-output transformer (see AUDIO SECTION description).

## RECEIVER SECTION

The incoming signal received by the antenna and arriving at the antenna connector via the transmission line is supplied to an impedance matching tap on coil L5, through capacitor C20. The resultant signal appearing across the broadly tuned circuit consisting of L5 and C21 is fed to the input of the RF amplifier stage V3A. The output circuit of the RF amplifier is "impedance coupled" to the cathode circuit of the superregenerative detector V3B through capacitor C24. This arrangement provides considerable gain in the RF stage, which does not require neutralization as the feed point in the detector circuit is relatively low impedance.

This means of coupling these two stages eliminates the most trying problem in most superregenerative detectors in that a condition referred to as "suck-out" can occur where a tuned circuit is not properly isolated from the detector. In other instances where a tuned circuit (it may be a coil and capacitor combination or reflected antenna tuning) is closely coupled, the detector will drop out of oscillation as detector tuning passes the resonant frequency of the interfering tuned circuit. In addition to solving the above problem and providing gain, the RF amplifier also isolates the antenna from the oscillating detector, minimizing re-radiation from the detector into the antenna.

The type of detector used is one which provides the most sensitivity for the number of components required and is superregenerative. In a straight regenerative detector, considerable sensitivity is achieved by adjusting the signal feedback of the detector for a near oscillating condition. In the regenerative circuit, the more feedback that can be employed with stable operation short of the detector actually going into oscillation, the greater will be the gain.

The superregenerative detector employed here carries the regenerative principle one step further in that the detector actually goes in and out of oscillation at a controlled rate. In doing such, the detector periodically passes through the point of maximum gain (just prior to oscillation) and therefore provides optimum gain from its circuit. This periodic rate, referred to as the "quench" frequency, is controlled by the value of RFC5, and associated components, and is in the vicinity of 20,000 cycles per second; therefore, the quench frequency is inaudible. The detector circuit is essentially a Colpitts type of oscillator circuit in which interelectrode tube and stray capacities form the normal feedback path. The detector cathode and heater are placed above RF ground by RF chokes RFC3 and RFC4. The plate circuit is bypassed for RF by C29.

The rear apron mounted 250 K $\Omega$  linear potentiometer R11 is adjusted for maximum sensitivity by setting the value of B+ voltage at the detector plate. The receiver configuration is one of very good sensitivity. Three microvolts input will produce near complete quieting with usable signals extending down to 1/2 microvolt.

## AUDIO SECTION

The detected audio signal passes through C30 to the 1 megohm volume control R13. Signal flow proceeds through the audio mixing resistor R22 to the grid of the audio driver V1A which is coupled to the power output stage V2 by capacitor C35. The combination modulation-output transformer T2 provides proper impedance matching to the speaker with the unit operating as a receiver. With the transmit-receive switch in the receive position, no loading of the audio output occurs at the primary modulation tap because the cathode circuit of the transmitter final amplifier is open. During receive, tubes V5, V4 and section V1B are inoperative.

During transmit conditions, only tube V3 is switched out of the circuit, with all other circuits operating. B+ is supplied to V5, V4A and V1B while the cathode of the final amplifier V4B is returned to ground. With B+ removed from the receiver section V3, no audio voltage appears across the volume control R13 and only the signal which is amplified by the microphone pre-amplifier V1B reaches the grid of the audio driver stage V1A.

External radio frequency energy is prevented from re-entering the audio circuitry via the microphone cable through the use of RF choke RFC6 and capacitor C41 in the microphone input circuit. In transmit, the volume control will have negligible effect on the amount of audio impressed on the RF carrier, the volume control being isolated by resistor R22. It will be found that fixed gain in the microphone audio circuit is adequate for all normal transmit conditions.

### CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. The arrangement shown is the result of extensive experimentation and trial. If followed carefully, the result will be a stable instrument, operating at a high degree of dependability. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

**UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST.** In so doing, you will become acquainted with the parts. Refer to the charts and other information on the inside covers of the manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein. Include all inspection slips in your letter to us. Hardware items are counted by weight, therefore, there may be a few more or less than the quantity specified. If a few are missing, please obtain them locally if at all possible.

In order to expedite delivery to you, we are occasionally forced to make minor substitution of parts. Such substitutions are carefully checked before they are approved and parts supplied will work satisfactorily. In checking the Parts

### POWER SUPPLY SECTION

The internal power supply provides the voltages necessary for proper operation from any 105-125 volt 50/60 cycle source. The B+ voltage is produced in a full-wave voltage doubler circuit consisting of D2, D3, C31 and C32. This DC voltage is then filtered by C33A and C33D, and distributed to the proper circuit points. Approximate B+ requirements are 260 volts 45 ma during receive and 90 ma during transmit.

The power connector on the chassis rear apron permits operation from any external source offering the proper voltages. The filament wiring is so arranged that the tubes are connected for either 6 or 12 volt operation, depending upon which power cable is in use. For 117 V AC operation, the power transformer provides 6.3 V AC for parallel wired filaments.

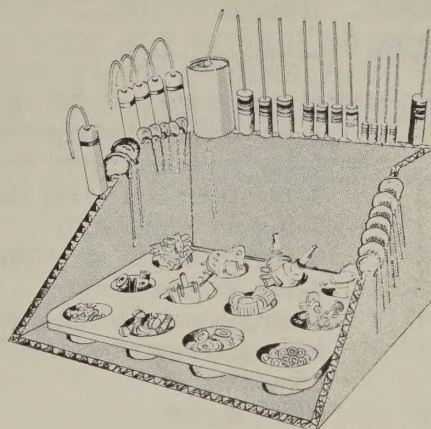
List for resistors, for example, you may find that a resistor with a 5% tolerance has been substituted for a resistor with a 10% tolerance, as shown in the Parts List. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -50% are common for electrolytic capacitors.

We suggest that you do the following before work is started:

1. Lay out all parts so that they are readily available.
2. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



Refer to Parts Pictorial on fold-out from page 11.

### PARTS LIST

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

#### Resistors

|       |   |                                                   |
|-------|---|---------------------------------------------------|
| 1-9   | 1 | 1000 $\Omega$ 1/2 watt<br>(brown-black-red)       |
| 1-14  | 2 | 3300 $\Omega$ 1/2 watt<br>(orange-orange-red)     |
| 1-23  | 1 | 27 K $\Omega$ 1/2 watt<br>(red-violet-orange)     |
| 1-26  | 3 | 100 K $\Omega$ 1/2 watt<br>(brown-black-yellow)   |
| 1-27  | 2 | 150 K $\Omega$ 1/2 watt<br>(brown-green-yellow)   |
| 1-29  | 1 | 220 K $\Omega$ 1/2 watt<br>(red-red-yellow)       |
| 1-30  | 2 | 270 K $\Omega$ 1/2 watt<br>(red-violet-yellow)    |
| 1-33  | 2 | 470 K $\Omega$ 1/2 watt<br>(yellow-violet-yellow) |
| 1-40  | 2 | 10 megohm 1/2 watt<br>(brown-black-blue)          |
| 1-42  | 1 | 270 $\Omega$ 1/2 watt<br>(red-violet-brown)       |
| 1-60  | 2 | 68 K $\Omega$ 1/2 watt<br>(blue-gray-orange)      |
| 1-66  | 1 | 150 $\Omega$ 1/2 watt<br>(brown-green-brown)      |
| 1A-4  | 1 | 8200 $\Omega$ 1 watt<br>(gray-red-red)            |
| 1A-5  | 1 | 22 K $\Omega$ 1 watt<br>(red-red-orange)          |
| 1A-9  | 1 | 10 K $\Omega$ 1 watt<br>(brown-black-orange)      |
| 1B-12 | 1 | 470 $\Omega$ 2 watt<br>(yellow-violet-brown)      |
| 1B-16 | 1 | 330 $\Omega$ 2 watt<br>(orange-orange-brown)      |

| PART No. | PARTS Per Kit | DESCRIPTION |
|----------|---------------|-------------|
|----------|---------------|-------------|

#### Capacitors

|        |    |                                                            |
|--------|----|------------------------------------------------------------|
| 20-52  | 1  | 7.5 $\mu$ f silver mica                                    |
| 20-97  | 2  | 50 $\mu$ f silver mica                                     |
| 20-99  | 1  | 22 $\mu$ f silver mica                                     |
| 21-14  | 24 | .001 $\mu$ f disc ceramic                                  |
| 21-16  | 1  | .01 $\mu$ f disc ceramic                                   |
| 21-28  | 5  | 10 $\mu$ f tubular ceramic                                 |
| 21-29  | 1  | 4.7 $\mu$ f tubular ceramic                                |
| 21-59  | 1  | .001 $\mu$ f ceramic<br>feed-through, 1000 V               |
| 21-70  | 1  | .01 $\mu$ f 1400 volt<br>disc ceramic                      |
| 25-57  | 2  | 100 $\mu$ f 200 volt electrolytic                          |
| ✓25-86 | 1  | 40-40-25-25 $\mu$ f at 450-350-<br>25-25 volt electrolytic |
| ✓26-71 | 1  | 3 $\mu$ f variable tuning<br>capacitor                     |
| 31-7   | 1  | 2.5 to 6 $\mu$ f trimmer                                   |

#### Transformers-Coils

|        |   |                                                  |
|--------|---|--------------------------------------------------|
| ✓51-43 | 1 | Combination modulation and<br>output transformer |
| ✓54-87 | 1 | Power transformer                                |
| ✓141-9 | 1 | Coil set                                         |

Consisting of:

|        |   |                           |
|--------|---|---------------------------|
| 40-186 | 1 | Oscillator plate coil     |
| 40-332 | 1 | Tripler coil              |
| 40-333 | 2 | Detector and doubler coil |
| 40-334 | 1 | Antenna coil              |
| 40-335 | 1 | Final tank coil           |
| 45-37  | 5 | RF choke                  |
| 45-48  | 1 | RF choke                  |

| PART<br>No. | PARTS<br>Per Kit | DESCRIPTION |
|-------------|------------------|-------------|
|-------------|------------------|-------------|

Terminal Strips-Sockets-Plugs

|        |   |                                |
|--------|---|--------------------------------|
| 431-1  | 1 | 1-lug terminal strip           |
| 431-5  | 1 | 4-lug terminal strip           |
| 431-10 | 1 | 3-lug terminal strip (large)   |
| 431-14 | 1 | 2-lug terminal strip           |
| 431-38 | 2 | 3-lug terminal strip (small)   |
| 431-40 | 2 | 4-lug terminal strip           |
| 432-1  | 1 | Microphone connector (cable)   |
| 432-3  | 1 | Microphone connector (chassis) |
| 434-4  | 2 | Octal socket                   |
| 434-15 | 1 | 7-pin socket                   |
| 434-38 | 1 | Crystal socket                 |
| 434-42 | 1 | Phono socket                   |
| 434-75 | 3 | 9-pin ceramic socket           |
| 434-77 | 1 | 9-pin wafer socket             |
| 435-1  | 1 | Octal socket ring              |
| 436-6  | 1 | 3-circuit phone jack           |
| 438-3  | 1 | Phone plug                     |
| 438-4  | 2 | Phono plug                     |
| 438-22 | 1 | Octal plug                     |
| 440-1  | 2 | Octal plug cap                 |

Controls-Switches

|          |   |                                                 |
|----------|---|-------------------------------------------------|
| 10-59    | 1 | 250 K $\Omega$ linear (REGENERATION)            |
| 19-27    | 1 | 1 megohm audio with SPST switch (VOLUME-ON-OFF) |
| ✓ 63-210 | 1 | 3-position, 4-circuit, TRANSMIT-RECEIVE switch  |

Diodes-Tubes-Lamps

|           |   |                         |
|-----------|---|-------------------------|
| 56-4      | 1 | Crystal diode           |
| 57-23     | 2 | Silicon diode           |
| ✓ 411-26  | 1 | 12AX7 tube              |
| ✓ 411-60  | 1 | 6AQ5 tube               |
| ✓ 411-98  | 2 | 6BA8 tube               |
| ✓ 411-121 | 1 | 6BS8 tube               |
| 412-1     | 1 | #47 pilot lamp          |
| 412-12    | 1 | Neon pilot lamp (clear) |
| 412-13    | 1 | Neon pilot lamp (red)   |

Metal Parts

|                |   |                      |
|----------------|---|----------------------|
| ✓ 90-111       | 1 | Cabinet              |
| ✓ 200-M280F398 | 1 | Chassis              |
| ✓ 203-181F397  | 1 | Front panel          |
| ✓ 205-M167F    | 1 | Speaker baffle plate |
| ✓ 209-25       | 1 | Speaker grill        |

| PART<br>No. | PARTS<br>Per Kit | DESCRIPTION |
|-------------|------------------|-------------|
|-------------|------------------|-------------|

Wire

|       |   |                                   |
|-------|---|-----------------------------------|
| 340-3 | 1 | Length #16 bare wire              |
| 344-1 | 1 | Length #22 hookup wire            |
| 344-2 | 1 | Length #18 stranded black wire    |
| 344-3 | 1 | Length #18 stranded red wire      |
| 346-1 | 1 | Length sleeving                   |
| 347-9 | 1 | Length 3-conductor shielded cable |

Hardware

|         |    |                              |
|---------|----|------------------------------|
| 250-26  | 1  | 6-32 x 5/8" screw            |
| 250-49  | 8  | 3-48 x 1/4" screw            |
| 250-51  | 2  | #10 x 3/8" sheet metal screw |
| 250-56  | 7  | 6-32 x 1/4" screw            |
| 250-89  | 12 | 6-32 x 3/8" screw            |
| 250-136 | 1  | 3-48 x 1/2" screw            |
| 250-172 | 2  | 3-48 x 3/8" screw            |
| 252-1   | 11 | 3-48 nut                     |
| 252-3   | 16 | 6-32 nut                     |
| 252-7   | 4  | Control nut                  |
| 252-22  | 4  | #6 speednut                  |
| 252-23  | 1  | 6-32 thumbnut                |
| 252-32  | 2  | Speednut                     |
| 253-10  | 5  | Flat control washer          |
| 253-21  | 6  | Flat washer                  |
| 254-1   | 20 | #6 lockwasher                |
| 254-4   | 5  | Control lockwasher           |
| 254-7   | 12 | #3 lockwasher                |
| 259-1   | 3  | #6 solder lug                |
| 259-11  | 3  | #6 spade terminal            |

Miscellaneous

|           |   |                                                  |
|-----------|---|--------------------------------------------------|
| 73-1      | 2 | 3/8" rubber grommet                              |
| 73-4      | 1 | 5/16" rubber grommet                             |
| ✓ 89-1    | 1 | Line cord                                        |
| ✓ 211-16  | 1 | Plastic handle                                   |
| 261-1     | 4 | Rubber feet                                      |
| ✓ 391-5   | 1 | Nameplate                                        |
| ✓ 401-21  | 1 | Speaker                                          |
| 421-1     | 2 | 1-1/2 ampere fuse (1 spare)                      |
| 421-4     | 2 | 8-ampere fuse (1 spare)                          |
| 423-1     | 1 | Fuse holder                                      |
| ✓ 446-M17 | 1 | Plastic window                                   |
| 462-85    | 2 | Knob w/gold insert and indicator dot             |
| 462-86    | 1 | Knob lever type w/gold insert and indicator line |
| ✓ 480-8   | 1 | Microphone                                       |
| 481-1     | 1 | 4-prong capacitor mounting wafer                 |
| 595-364   | 1 | Manual                                           |

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

## PROPER SOLDERING TECHNIQUES

Only a small percentage of HEATHKIT® equipment purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest portion malfunction due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

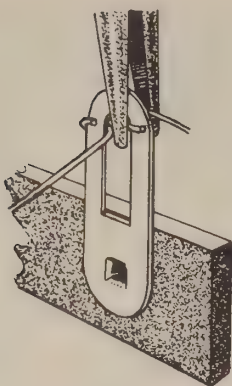
For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

### CHASSIS WIRING AND SOLDERING

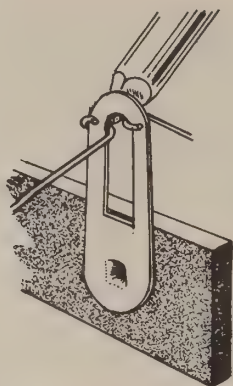
1. Unless otherwise indicated, all wire used is the type with colored insulation (hookup wire); the size of the conductor is the same for all colors of hookup wires furnished with this kit. In preparing a length of hookup wire,

1/4" of insulation should be removed from each end unless directed otherwise in the construction step.

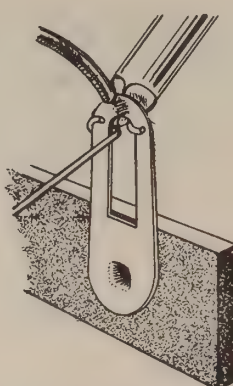
2. To avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, care should be taken not to pull directly on the lead. Instead, hold the lead with pliers while it is being stripped.
3. Leads on resistors, capacitors and similar components are generally much longer than they need to be to make the required connections. In these cases, the leads should be cut to proper length before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points.
4. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving. Where the use of sleeving is specifically intended, the phrase "use sleeving" is included in the associated construction step. In any case where there is the possibility of an unintentional short circuit, sleeving should be used. Extra sleeving is provided for this purpose.



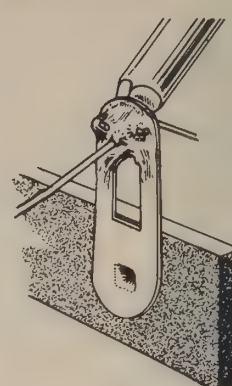
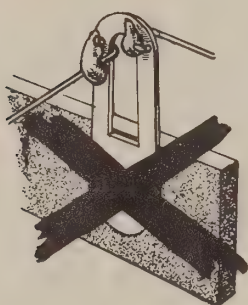
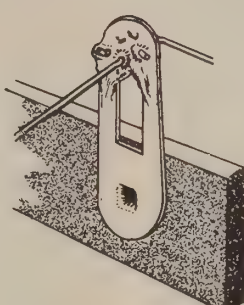
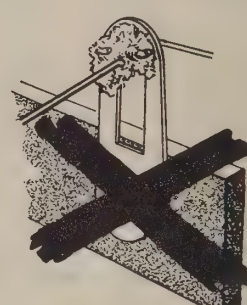
CRIMP WIRES



HEAT CONNECTION



APPLY SOLDER

ALLOW SOLDER  
TO FLOWCOLD SOLDER JOINT  
CONNECTION INSUFFICIENTLY  
HEATEDPROPER SOLDER  
CONNECTIONCOLD SOLDER JOINT  
CONNECTION MOVED  
WHILE COOLING

5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength, unless otherwise instructed in the STEP-BY-STEP ASSEMBLY. If the wire is too large to allow bending or if the step states that the wire is not to be crimped, position the wire so that a good solder connection can still be made.
  6. Position the work, if possible, so that gravity will help to keep the solder where you want it.
  7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
  8. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
  9. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.
- A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth bright appearance.

## STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning the specified operation. Also read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have also found it helpful to mark each lead in colored pencil on the Pictorial as it is added.

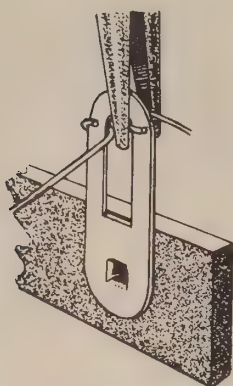
The fold-out diagrams in this manual may be removed and attached to the wall above your working area; but, because they are an integral part of the instructions, they should be returned to the manual after the kit is completed.

In general, the illustrations in this manual correspond to the actual configuration of the kit; however, in some instances the illustrations may be slightly distorted to facilitate

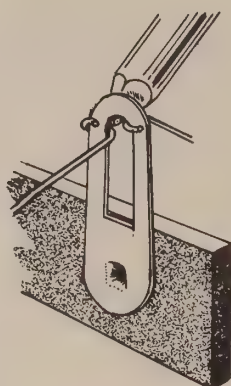
clearly showing all of the parts.

The abbreviation "NS" indicates that a connection should not be soldered yet as other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in point before it is soldered. For example, if the instruction reads, "Connect a lead to lug 1 (S-2)," it will be understood that there will be two leads connected to the terminal at the time it is soldered. (In cases where a lead passes through a terminal or lug and then connects to another point, it will count as two leads, one entering and one leaving the terminal.)

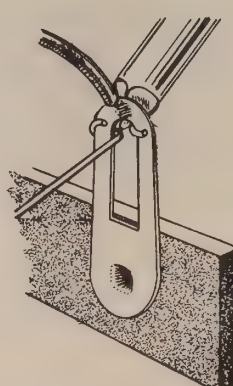
The steps directing the installation of resistors include color codes to help identify the parts. Also, if a part is identified by a letter-number designation on the Schematic, its designation will appear in the construction step which directs its installation.



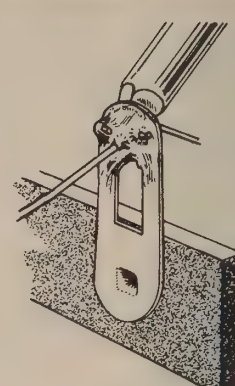
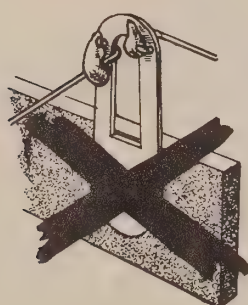
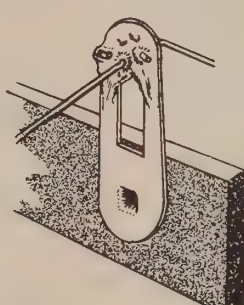
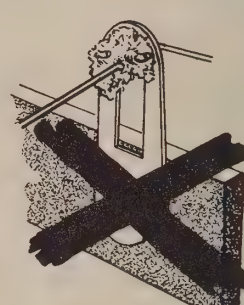
CRIMP WIRES



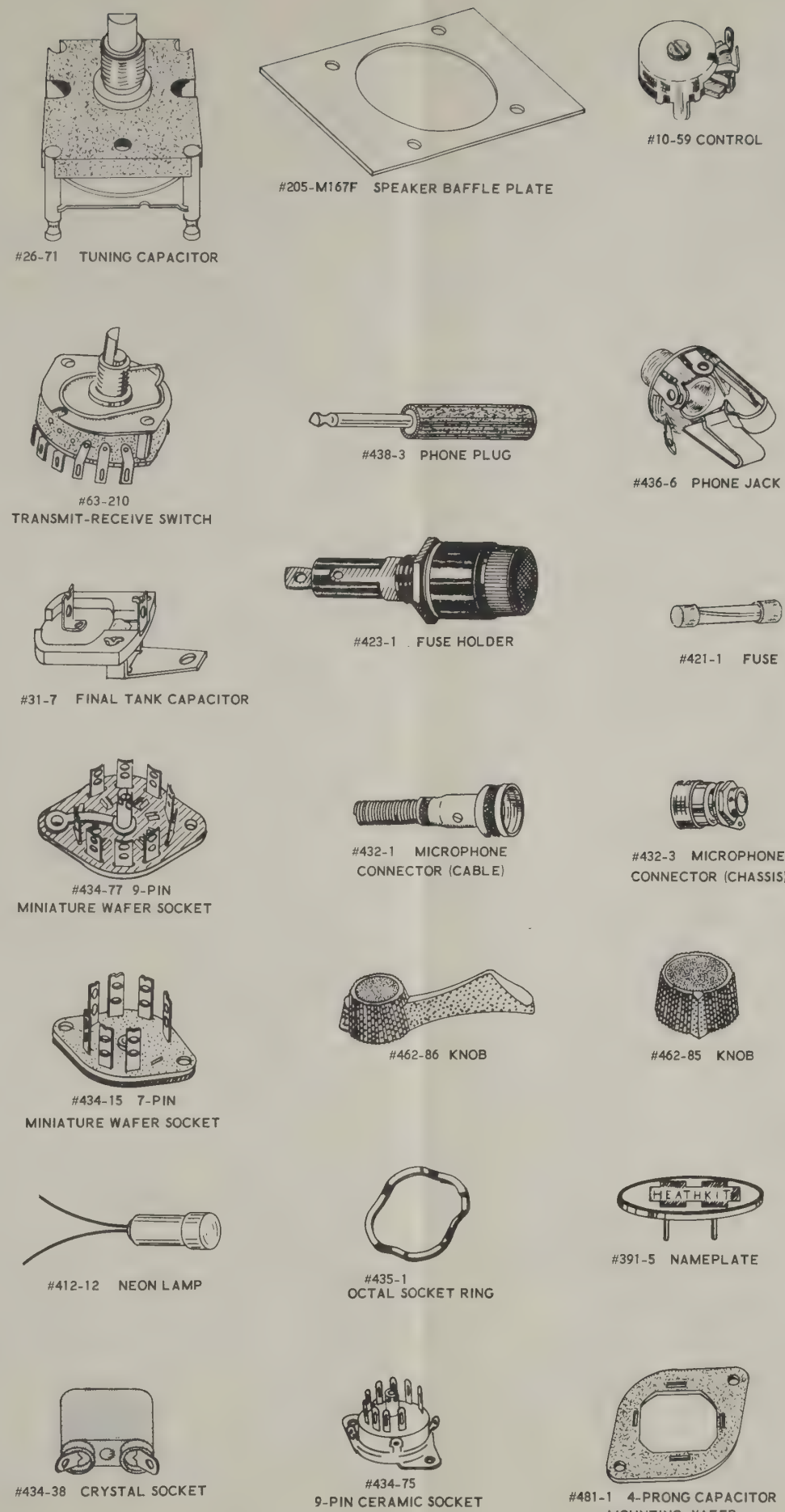
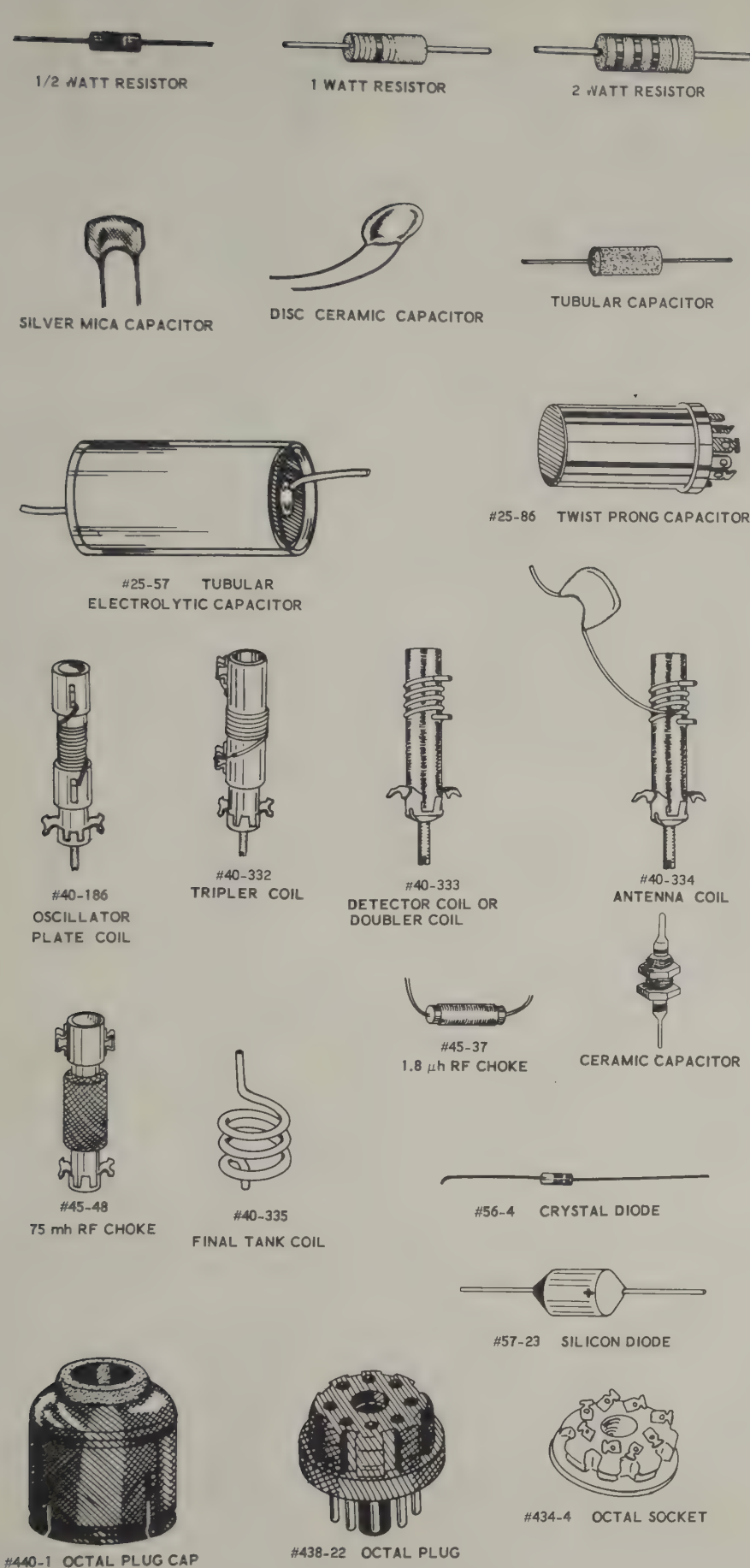
HEAT CONNECTION

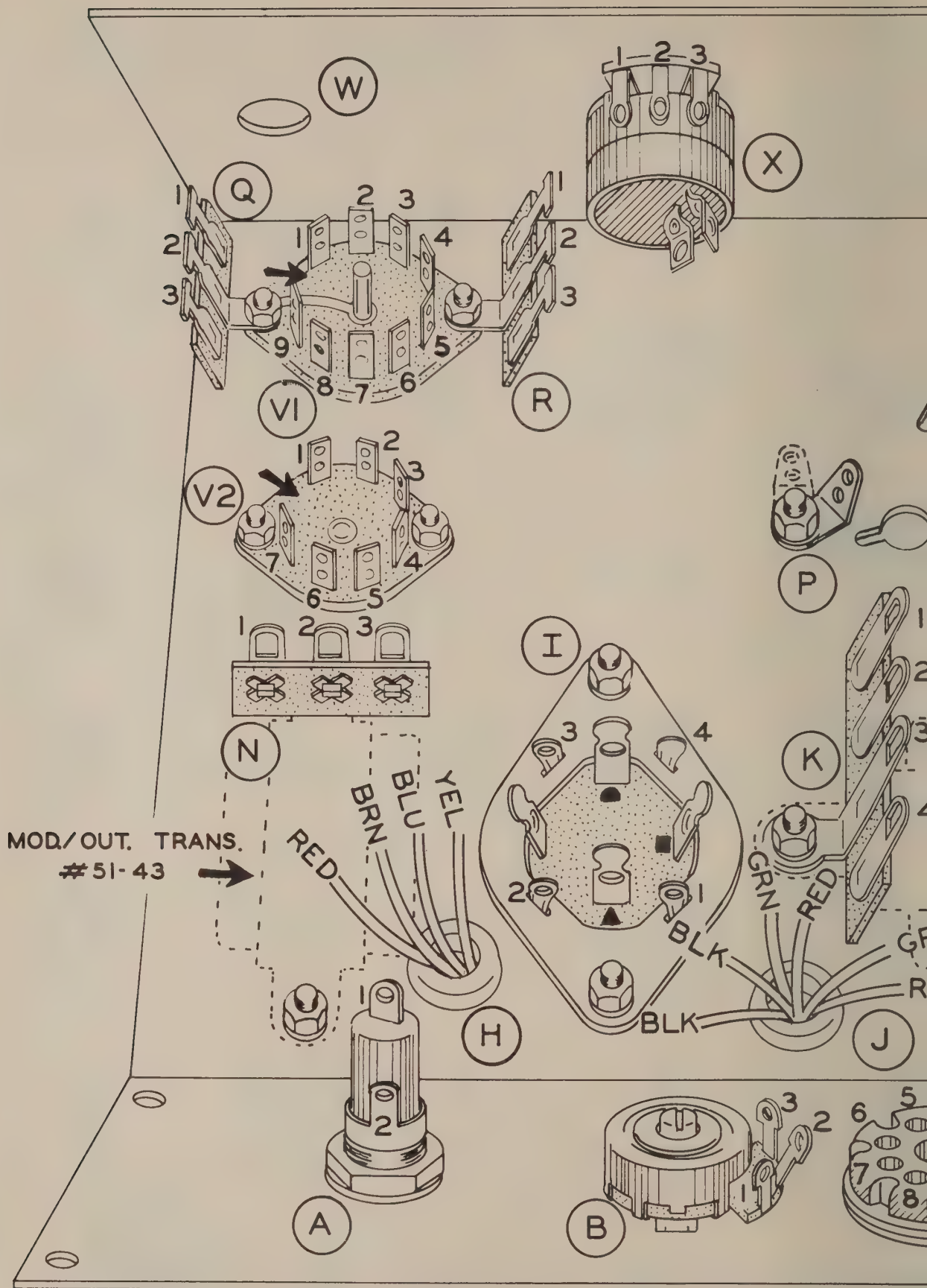


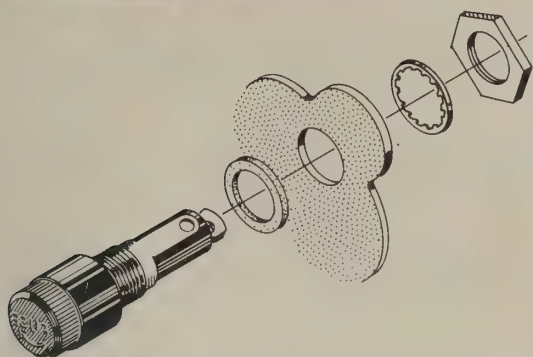
APPLY SOLDER

ALLOW SOLDER  
TO FLOWCOLD SOLDER JOINT  
-CONNECTION INSUFFICIENTLY  
HEATEDPROPER SOLDER  
CONNECTIONCOLD SOLDER JOINT  
CONNECTION MOVED  
WHILE COOLING

5. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength, unless otherwise instructed in the STEP-BY-STEP ASSEMBLY. If the wire is too large to allow bending or if the step states that the wire is not to be crimped, position the wire so that a good solder connection can still be made.
  6. Position the work, if possible, so that gravity will help to keep the solder where you want it.
  7. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.
  8. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.
  9. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.
- A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth bright appearance.







Detail 1D

- (✓) Referring to Detail 1D, mount fuse holder A. Use the hardware that is furnished with the fuse holder. Bend lug 2 of the fuse holder up slightly so that a wire can be connected to it later. Install one of the 1-1/2 ampere fuses in the fuse holder.

Cut the power transformer leads (#54-87) to the following lengths. Strip 1/4" of insulation from the end of each wire (unless directed otherwise) and tin the wire. ("Tin" means to melt a small amount of solder on the bare end of the wire.)

| Color            | Length  |
|------------------|---------|
| (✓) Either black | 5-3/4"  |
| (✓) Other black  | 5-3/4"* |
| (✓) Either green | 4-1/2"* |
| (✓) Other green  | 3-1/4"  |

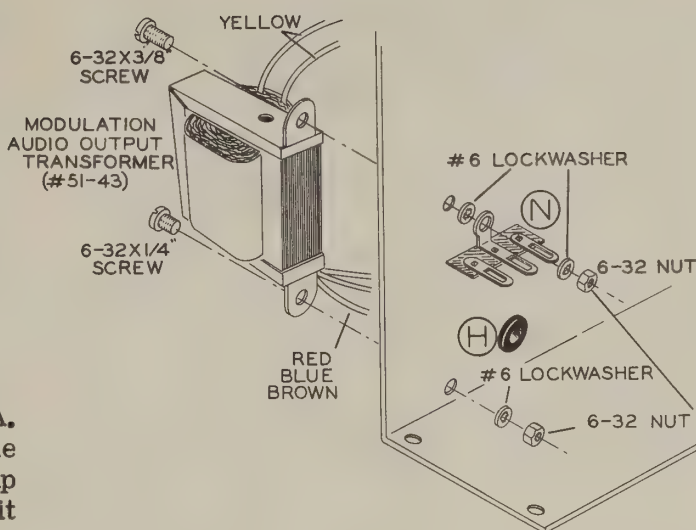
The red wires are of the proper length and need not be cut.

\*Remove 5/8" of insulation.

Similarly, prepare the combination modulation-audio transformer (#51-43) leads to the following lengths:

| Color             | Length |
|-------------------|--------|
| (✓) Red           | 4-3/4" |
| (✓) Blue          | 3-3/4" |
| (✓) Either yellow | 3-1/2" |
| (✓) Other yellow  | 3"     |

The brown wire is cut to the proper length.

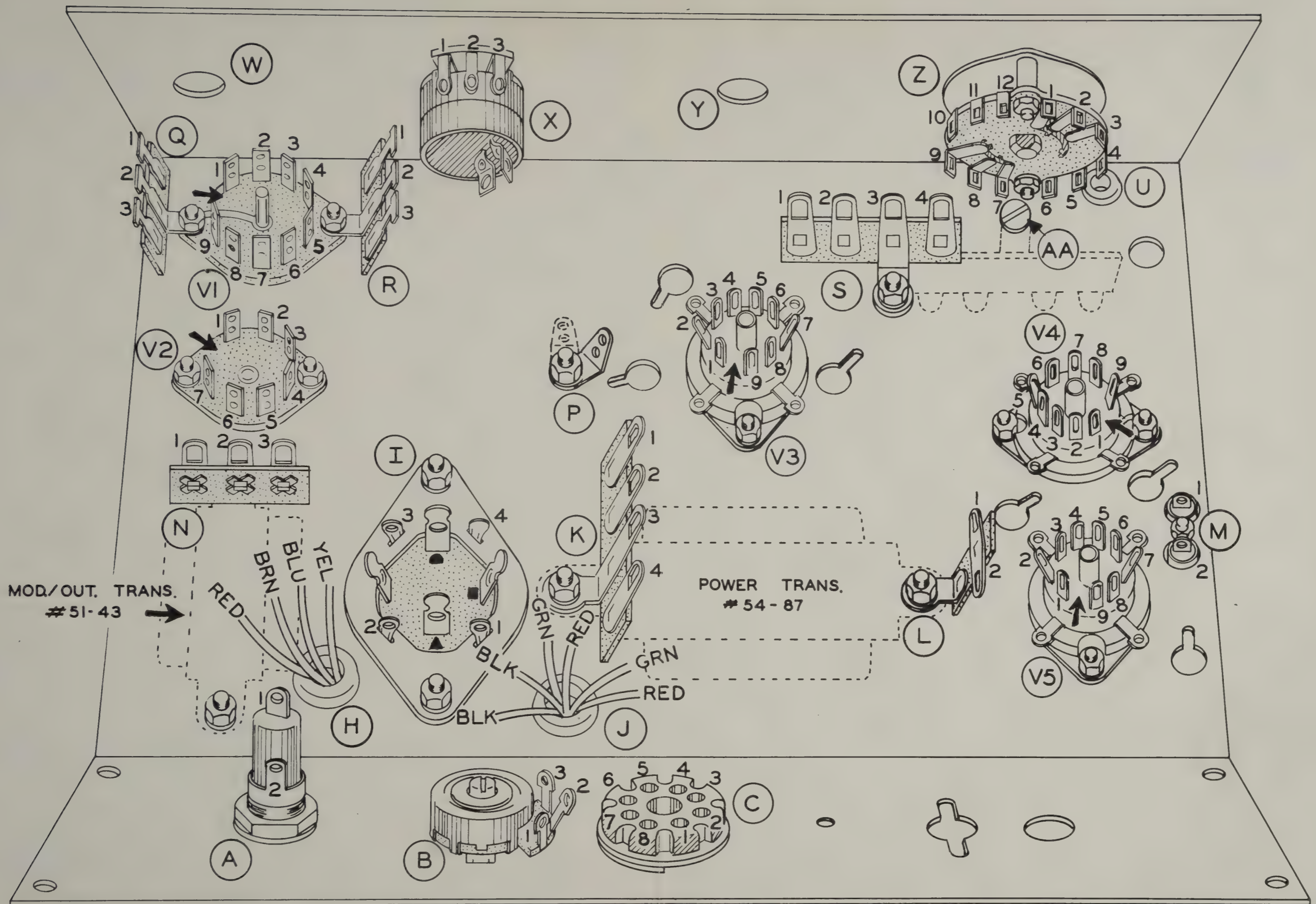


Detail 1E

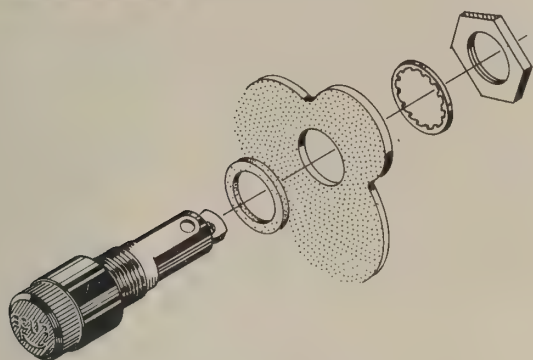
- (✓) Referring to Detail 1E, mount the combination modulation-audio (#51-43) transformer and 3-lug terminal strip N. Orient the transformer so that the red, blue and brown leads are next to grommet H. Place a 6-32 x 3/8" screw through the transformer mounting foot, then through the chassis. Slip a #6 lockwasher and 3-lug terminal strip N over the screw. Secure the screw with another #6 lockwasher and 6-32 nut.

- (✓) Now, secure the other mounting foot with a 6-32 x 1/4" screw, #6 lockwasher and 6-32 nut.

- (✓) Similarly, mount the power transformer (#54-87), 4-lug terminal strip K and 1-lug terminal strip L. Orient the power transformer so that the red and green wires are located close to grommet J. Use 6-32 x 3/8" BHMS. See Pictorial 1 and the fold-out Figure 8 (Page 32).



Pictorial 1



Detail 1D

- (✓) Referring to Detail 1D, mount fuse holder A. Use the hardware that is furnished with the fuse holder. Bend lug 2 of the fuse holder up slightly so that a wire can be connected to it later. Install one of the 1-1/2 ampere fuses in the fuse holder.

Cut the power transformer leads (#54-87) to the following lengths. Strip 1/4" of insulation from the end of each wire (unless directed otherwise) and tin the wire. ("Tin" means to melt a small amount of solder on the bare end of the wire.)

| <u>Color</u>     | <u>Length</u> |
|------------------|---------------|
| (✓) Either black | 5-3/4"        |
| (✓) Other black  | 5-3/4"*       |
| (✓) Either green | 4-1/2"*       |
| (✓) Other green  | 3-1/4"        |

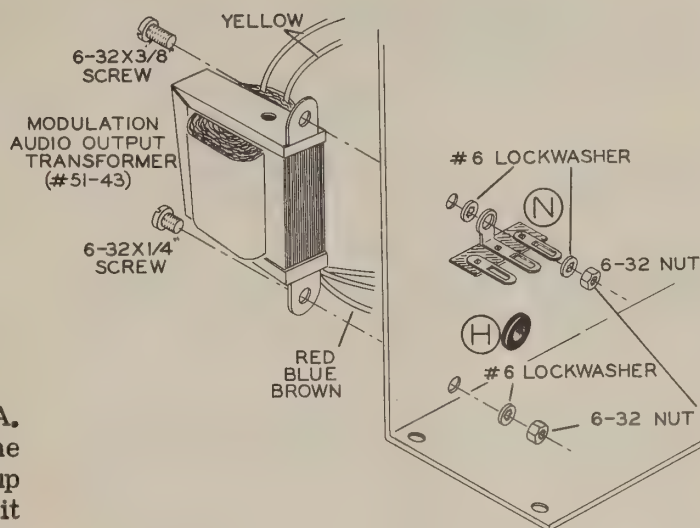
The red wires are of the proper length and need not be cut.

\*Remove 5/8" of insulation.

Similarly, prepare the combination modulation-audio transformer (#51-43) leads to the following lengths:

| <u>Color</u>      | <u>Length</u> |
|-------------------|---------------|
| (✓) Red           | 4-3/4"        |
| (✓) Blue          | 3-3/4"        |
| (✓) Either yellow | 3-1/2"        |
| (✓) Other yellow  | 3"            |

The brown wire is cut to the proper length.



Detail 1E

- (✓) Referring to Detail 1E, mount the combination modulation-audio transformer (#51-43) transformer and 3-lug terminal strip N. Orient the transformer so that the red, blue and brown leads are next to grommet H. Place a 6-32 x 3/8" screw through the transformer mounting foot, then through the chassis. Slip a #6 lockwasher and 3-lug terminal strip N over the screw. Secure the screw with another #6 lockwasher and 6-32 nut.

- (✓) Now, secure the other mounting foot with a 6-32 x 1/4" screw, #6 lockwasher and 6-32 nut.

- (✓) Similarly, mount the power transformer (#54-87), 4-lug terminal strip K and 1-lug terminal strip L. Orient the power transformer so that the red and green wires are located close to grommet J. Use 6-32 x 3/8" BHMS. See Pictorial 1 and the fold-out Figure 8 (Page 32).

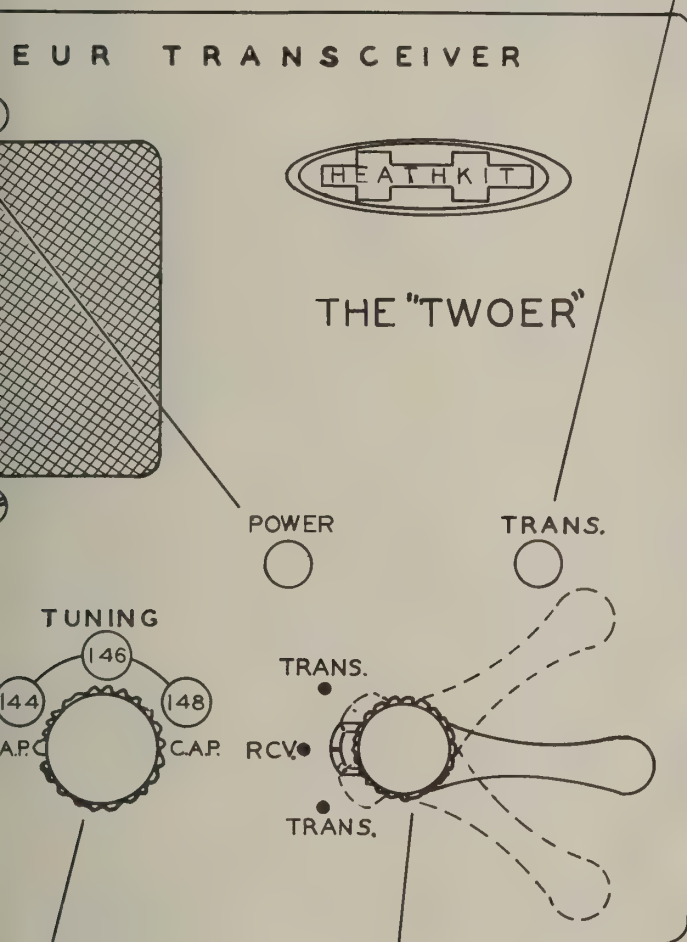
- (✓) Connect a 2" wire from lug 2 of terminal strip R (NS) to lug 1 of control X (S-1).
- (✓) Twist a 7" wire and a 7-3/4" wire together. Strip 5/8" of insulation from one end of the 7" wire and 1/4" from each of the three other wire ends.
- (✓) Connect the end of the wire stripped 5/8" to pin 6 of power plug C (S-1). Connect the other wire at this end of the twisted pair to lug 2 of fuse holder A (S-1).
- (✓) Connect the other end of either of the twisted wires to lug 4 of control X (S-1).
- (✓) Connect the other twisted wire to lug 5 of control X (S-1).
- (✓) Strip 5/8" of insulation from one end of a 3-1/2" wire. Connect this wire from pin 5 of power plug C (S-1) to lug 2 of terminal strip K (NS).
- (✓) Connect a 7-1/4" wire from lug 1 of control B (S-1) to lug 2 of terminal strip S (NS).
- (✓) Connect a 3-1/4" wire from lug 2 of control B (S-1) to lug 1 of terminal strip K (NS).
- (✓) Connect a 1-1/2" wire from lug 3 of terminal strip S (S-1) to lug 6 of switch Z (S-1). Form the wire close to the chassis to clear lug 4 of terminal strip S and switch lug 7.
- (✓) Connect a 2" wire from lug 2 of terminal strip S (NS) to lug 7 of switch Z (S-1).
- (✓) Connect a 3" wire to lug 2 of switch Z (NS). Insert the free end of this wire through grommet U. It will be connected later.
- (✓) Connect a 3-1/4" wire to lug 3 of switch Z (S-2). Insert the free end of this wire through grommet U. It will be connected later.

NOTE: For the following steps, use the heavy bare wire or use completely stripped hookup wire, whichever is indicated. When using ordinary hookup wire, it is usually best to wrap the leads around the lugs. However, it is suggested that you do not attempt to wrap the heavy bare wire, since you may damage the component.

- (✓) Connect a length of stripped hookup wire between lug 3 (NS) and the center post (NS) of tube socket V1.
- (✓) Connect a length of stripped hookup wire from the center post of tube socket V1 (S-2) through lug 4 of V1 (NS) to the hole in the bottom of lug 2 of terminal strip R (NS).
- (✓) Connect a length of heavy bare wire from the center post of tube socket V3 (NS) to the ground lug nearest lug 1 of V3 (S-1).
- (✓) Connect another length of heavy bare wire from the center post of V3 (NS) through lug 9 (NS) to the ground lug nearest lug 8 (NS) of V3.
- (✓) Connect a length of heavy bare wire from the ground lug nearest lug 5 of tube socket V4 (S-1) through lug 5 (S-1) to the center post of V4 (NS).
- (✓) Connect another length of heavy bare wire from the ground lug nearest lug 1 of tube socket V4 (NS) through lug 1 (NS) to the center post of V4 (NS).
- (✓) Connect a length of heavy bare wire from the ground post nearest lug 1 of tube socket V5 (NS) through lug 1 (NS), through the center post (NS), through lug 6 (NS), and to the ground lug nearest lug 6 of V5 (NS). Now solder lugs 1 and 6 of V5.
- (✓) Connect a length of heavy bare wire from pin 7 of power plug C (S-1) to lug 1 of fuse holder A (S-2). Use sleeving.

## FUNCTIONS

Trans. Indicator. Informs the operator that the unit is on transmit by indicating the presence of B+ in the transmitter section.

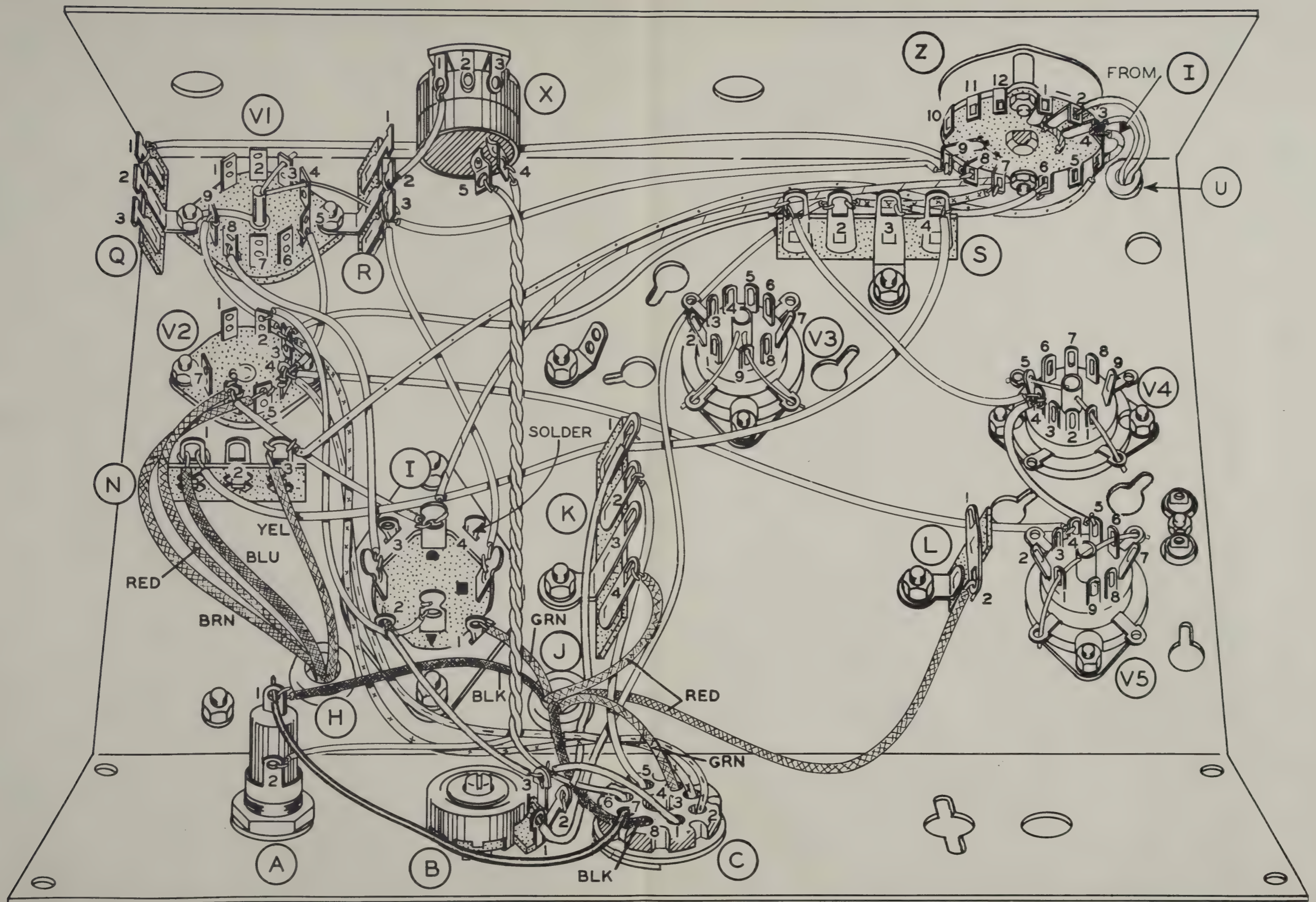


TRANSMIT-RECEIVE Switch. The middle, or RECEIVE position actuates the receiver section of the HW-30. Pushing the knob down permits short transmissions of an intermittent nature, and is comparable to a similar function provided in many intercoms. Lifting up allows continuous transmission for longer periods of time without continuous pressure. This position would normally be used primarily for mobile operation. Both TRANSMIT positions perform the same functions electrically.

- (✓) Connect a 2" wire from lug 2 of terminal strip R (NS) to lug 1 of control X (S-1).
- (✓) Twist a 7" wire and a 7-3/4" wire together. Strip 5/8" of insulation from one end of the 7" wire and 1/4" from each of the three other wire ends.
- (✓) Connect the end of the wire stripped 5/8" to pin 6 of power plug C (S-1). Connect the other wire at this end of the twisted pair to lug 2 of fuse holder A (S-1).
- (✓) Connect the other end of either of the twisted wires to lug 4 of control X (S-1).
- (✓) Connect the other twisted wire to lug 5 of control X (S-1).
- (✓) Strip 5/8" of insulation from one end of a 3-1/2" wire. Connect this wire from pin 5 of power plug C (S-1) to lug 2 of terminal strip K (NS).
- (✓) Connect a 7-1/4" wire from lug 1 of control B (S-1) to lug 2 of terminal strip S (NS).
- (✓) Connect a 3-1/4" wire from lug 2 of control B (S-1) to lug 1 of terminal strip K (NS).
- (✓) Connect a 1-1/2" wire from lug 3 of terminal strip S (S-1) to lug 6 of switch Z (S-1). Form the wire close to the chassis to clear lug 4 of terminal strip S and switch lug 7.
- (✓) Connect a 2" wire from lug 2 of terminal strip S (NS) to lug 7 of switch Z (S-1).
- (✓) Connect a 3" wire to lug 2 of switch Z (NS). Insert the free end of this wire through grommet U. It will be connected later.
- (✓) Connect a 3-1/4" wire to lug 3 of switch Z (S-2). Insert the free end of this wire through grommet U. It will be connected later.

NOTE: For the following steps, use the heavy bare wire or use completely stripped hookup wire, whichever is indicated. When using ordinary hookup wire, it is usually best to wrap the leads around the lugs. However, it is suggested that you do not attempt to wrap the heavy bare wire, since you may damage the component.

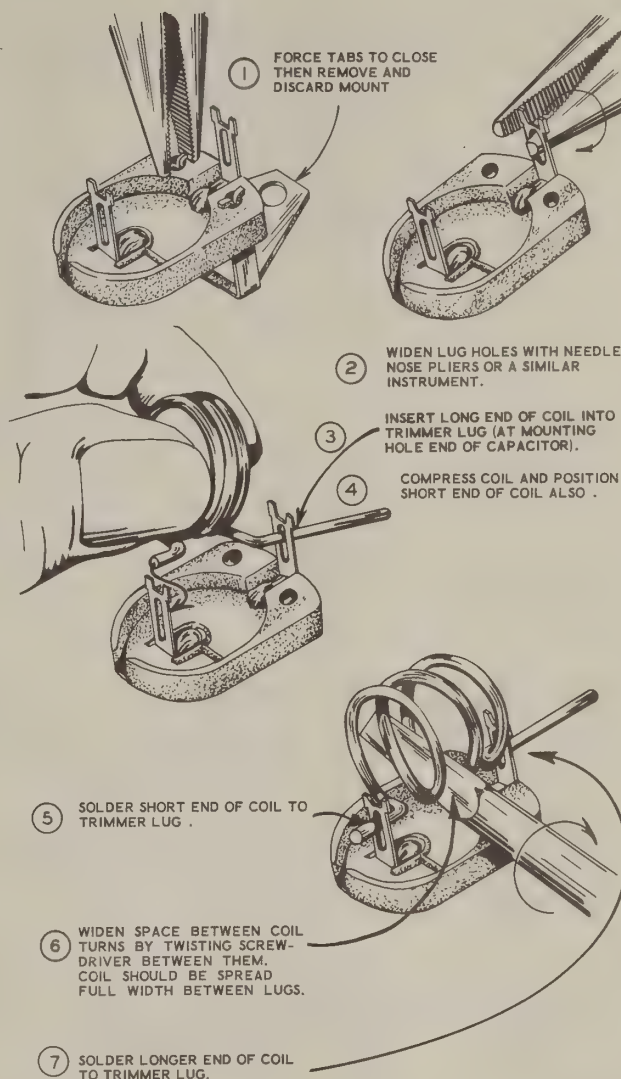
- (✓) Connect a length of stripped hookup wire between lug 3 (NS) and the center post (NS) of tube socket V1.
- (✓) Connect a length of stripped hookup wire from the center post of tube socket V1 (S-2) through lug 4 of V1 (NS) to the hole in the bottom of lug 2 of terminal strip R (NS).
- (✓) Connect a length of heavy bare wire from the center post of tube socket V3 (NS) to the ground lug nearest lug 1 of V3 (S-1).
- (✓) Connect another length of heavy bare wire from the center post of V3 (NS) through lug 9 (NS) to the ground lug nearest lug 8 (NS) of V3.
- (✓) Connect a length of heavy bare wire from the ground lug nearest lug 5 of tube socket V4 (S-1) through lug 5 (S-1) to the center post of V4 (NS).
- (✓) Connect another length of heavy bare wire from the ground lug nearest lug 1 of tube socket V4 (NS) through lug 1 (NS) to the center post of V4 (NS).
- (✓) Connect a length of heavy bare wire from the ground post nearest lug 1 of tube socket V5 (NS) through lug 1 (NS), through the center post (NS), through lug 6 (NS), and to the ground lug nearest lug 6 of V5 (NS). Now solder lugs 1 and 6 of V5.
- (✓) Connect a length of heavy bare wire from pin 7 of power plug C (S-1) to lug 1 of fuse holder A (S-2). Use sleeving.



Pictorial 2



- (✓) C11. Connect a 10  $\mu\mu\text{f}$  tubular ceramic capacitor from lug 1 of coil CE (NS) to lug 7 of tube socket V4 (S-2).
- (✓) Connect a very short length of stripped hookup wire from lug 1 of coil CE (S-2) to lug 3 of tube socket V4 (S-1). Be sure that it does not short to lug 2 of V4.
- (✓) Mount the oscillator coil (#40-186) CF.
- (✓) Connect a 3" length of hookup wire from lug 2 of coil CD (NS) to lug 2 of coil CF (NS).
- (✓) Connect a 4-3/4" length of hookup wire from lug 2 of coil CD (S-4) to lug 2 of switch Z (S-2).
- (✓) C4. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 2 of coil CF (NS) to the ground lug nearest lug 8 of tube socket V5 (S-1).
- (✓) R2. Connect a 22 K $\Omega$  (red-red-orange) 1 watt resistor from lug 2 crystal socket M (S-2) to lug 2 of coil CF (NS).
- (✓) C5. Connect a 10  $\mu\mu\text{f}$  tubular ceramic capacitor between lugs 1 (NS) and 2 (S-4) of coil CF.
- (✓) Connect a length of stripped hookup wire from lug 1 of coil CF (S-2) to lug 9 of tube socket V5 (NS).
- (✓) C6. Connect a 50  $\mu\mu\text{f}$  silver mica capacitor between lugs 2 (S-2) and 9 (S-2) of tube socket V5.
- (✓) Connect a length of heavy bare wire from lug 1 of coil CD (S-1) to lug 3 of tube socket V5 (S-2).
- (✓) C7. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 4 of tube socket V5 (S-2) to the center post of V5 (NS).
- (✓) C2. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 5 (S-2) to the center lug of V5 (S-4).
- (✓) Install the .001  $\mu\text{fd}$  feed-through capacitor T. Use the nut furnished with the capacitor. Do not overtighten this capacitor since you may crack the insulating material. See Detail 4B.



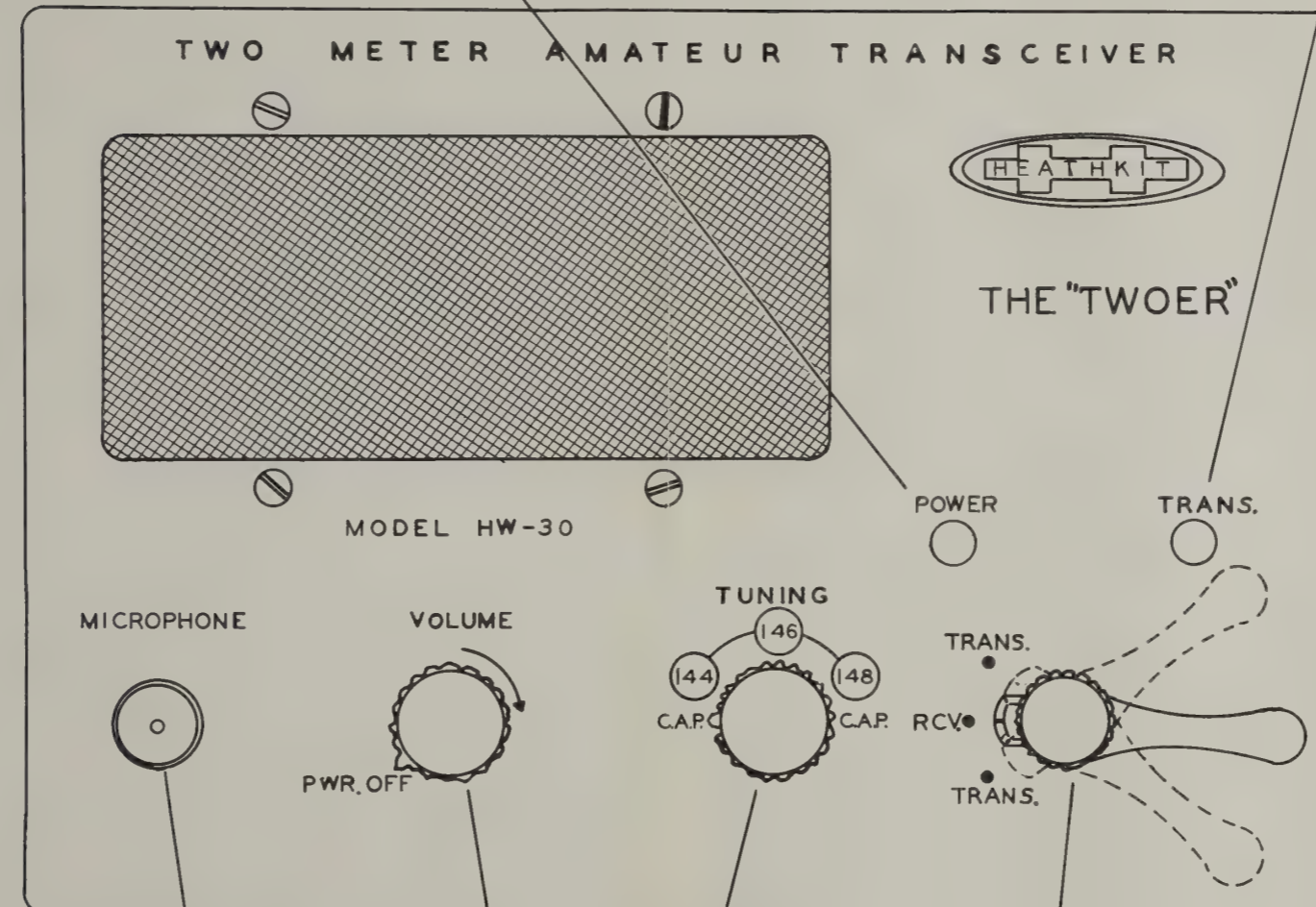
Detail 4C

- (✓) Now, cut the lead extending from the top of the feed-through capacitor flush with the top of the insulating material. See Detail 4B.
- (✓) Cut the lead extending from the bottom of the feed-through capacitor to 1/4" as shown in Detail 4B.
- (✓) Connect a 2-1/2" wire from lug 4 of terminal strip S (S-3) to feed-through capacitor T (NS).
- (✓) Prepare the final tank coil (#40-335) and trimmer capacitor C16 as shown in Detail 4C.

## CONTROL FUNCTIONS

Power Indicator. Informs the operator when power is applied to the unit.

Trans. Indicator. Informs the operator that the unit is on transmit by indicating the presence of B+ in the transmitter section.



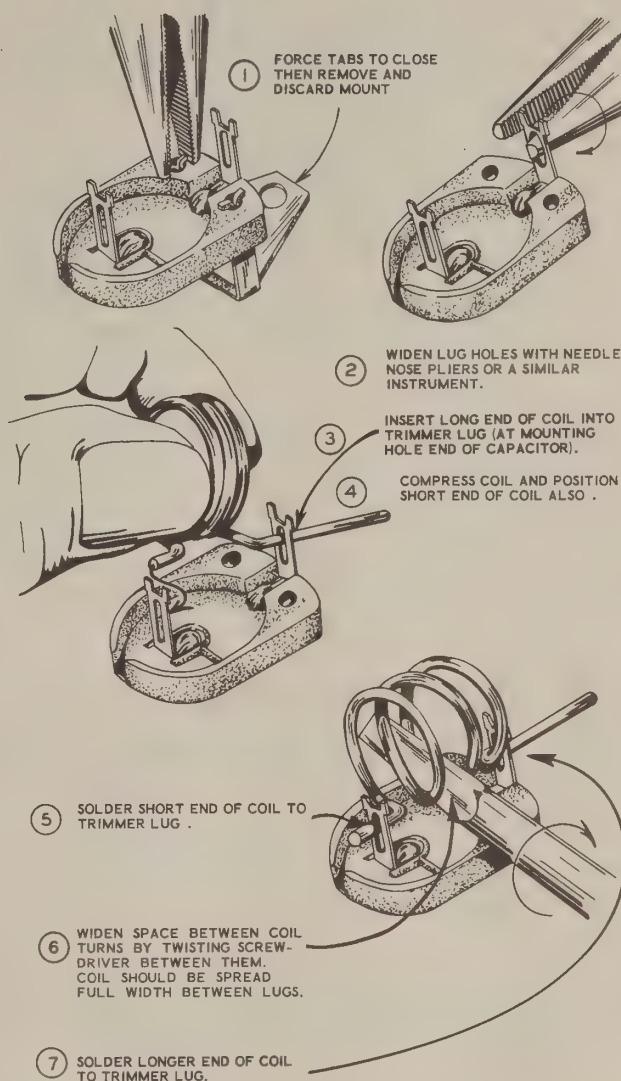
Microphone Connector. The electrical connections between the microphone and unit are made via this connector, to permit removal of the microphone as desired.

VOLUME Control. Permits varying the sound output from the speaker to suit your individual desire. A switch at the counterclockwise end of rotation disconnects the unit from its power source.

TUNING Control. Permits the receiver to be tuned at will. Note that this control has NO effect on transmitter frequency.

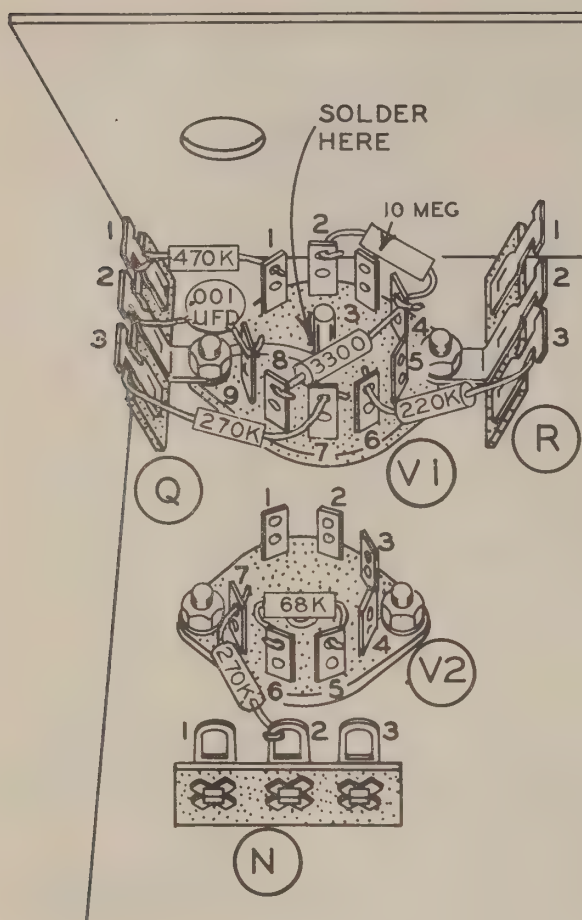
TRANSMIT-RECEIVE Switch. The middle, or RECEIVE position actuates the receiver section of the HW-30. Pushing the knob down permits short transmissions of an intermittent nature, and is comparable to a similar function provided in many intercoms. Lifting up allows continuous transmission for longer periods of time without continuous pressure. This position would normally be used primarily for mobile operation. Both TRANSMIT positions perform the same functions electrically.

- (✓) C11. Connect a 10  $\mu\mu\text{f}$  tubular ceramic capacitor from lug 1 of coil CE (NS) to lug 7 of tube socket V4 (S-2).
- (✓) Connect a very short length of stripped hookup wire from lug 1 of coil CE (S-2) to lug 3 of tube socket V4 (S-1). Be sure that it does not short to lug 2 of V4.
- (✓) Mount the oscillator coil (#40-186) CF.
- (✓) Connect a 3" length of hookup wire from lug 2 of coil CD (NS) to lug 2 of coil CF (NS).
- (✓) Connect a 4-3/4" length of hookup wire from lug 2 of coil CD (S-4) to lug 2 of switch Z (S-2).
- (✓) C4. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 2 of coil CF (NS) to the ground lug nearest lug 8 of tube socket V5 (S-1).
- (✓) R2. Connect a 22 K $\Omega$  (red-red-orange) 1 watt resistor from lug 2 crystal socket M (S-2) to lug 2 of coil CF (NS).
- (✓) C5. Connect a 10  $\mu\mu\text{f}$  tubular ceramic capacitor between lugs 1 (NS) and 2 (S-4) of coil CF.
- (✓) Connect a length of stripped hookup wire from lug 1 of coil CF (S-2) to lug 9 of tube socket V5 (NS).
- (✓) C6. Connect a 50  $\mu\mu\text{f}$  silver mica capacitor between lugs 2 (S-2) and 9 (S-2) of tube socket V5.
- (✓) Connect a length of heavy bare wire from lug 1 of coil CD (S-1) to lug 3 of tube socket V5 (S-2).
- (✓) C7. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 4 of tube socket V5 (S-2) to the center post of V5 (NS).
- (✓) C2. Connect a .001  $\mu\text{fd}$  disc ceramic capacitor from lug 5 (S-2) to the center lug of V5 (S-4).
- (✓) Install the .001  $\mu\text{fd}$  feed-through capacitor T. Use the nut furnished with the capacitor. Do not overtighten this capacitor since you may crack the insulating material. See Detail 4B.



Detail 4C

- (✓) Now, cut the lead extending from the top of the feed-through capacitor flush with the top of the insulating material. See Detail 4B.
- (✓) Cut the lead extending from the bottom of the feed-through capacitor to 1/4" as shown in Detail 4B.
- (✓) Connect a 2-1/2" wire from lug 4 of terminal strip S (S-3) to feed-through capacitor T (NS).
- (✓) Prepare the final tank coil (#40-335) and trimmer capacitor C16 as shown in Detail 4C.

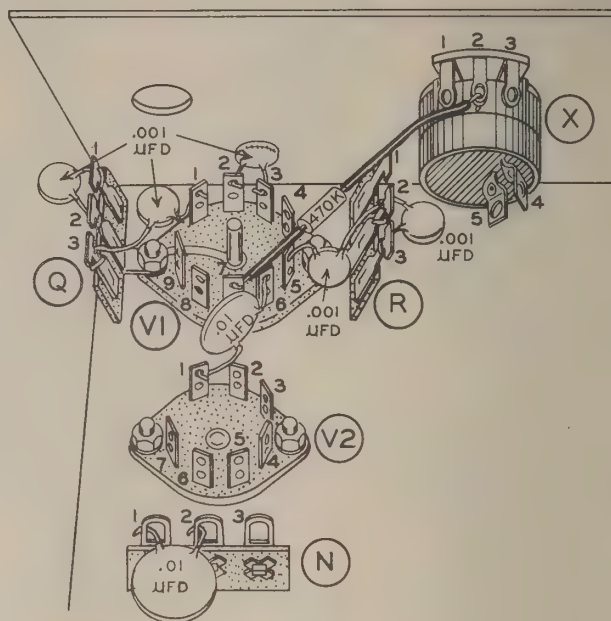


Pictorial 7

**AUDIO SECTION WIRING**

Refer to Pictorial 7 for the following steps.

- (✓) On tube socket V1, solder the center post to the center post grounding strap at the point indicated on Pictorial 7.
- (✓) R26. Connect a 10 megohm (brown-black-blue) resistor between lugs 2 (NS) and 4 (NS) of tube socket V1.
- (✓) R21. Connect a 3300  $\Omega$  (orange-orange-red) resistor between lugs 8 (S-2) and 4 (S-4) of tube socket V1.
- (✓) R20. Connect a 220 K $\Omega$  (red-red-yellow) resistor from lug 6 of tube socket V1 (NS) to lug 3 of terminal strip R (NS).
- (✓) R23. Connect a 270 K $\Omega$  (red-violet-yellow) resistor from lug 7 of tube socket V1 (NS) to lug 3 of terminal strip Q (NS).



Pictorial 8

- (✓) R24. Connect a 470 K $\Omega$  (yellow-violet-yellow) resistor from lug 1 of tube socket V1 (NS) to lug 1 of terminal strip Q (NS).
  - (✓) R17. Connect a 68 K $\Omega$  (blue-gray-orange) resistor between lugs 6 (S-3) and 5 (S-2) of tube socket V2.
  - (✓) C39. Connect a .001  $\mu$ fd disc ceramic capacitor from lug 9 of tube socket V1 (S-2) to lug 2 of terminal strip Q (NS).
  - (✓) R19. Connect a 270 K $\Omega$  (red-violet-yellow) resistor from lug 7 of tube socket V2 (S-1) to lug 2 of terminal strip N (NS).
- Refer to Pictorial 8 for the following steps.
- (✓) C34. Connect a .01  $\mu$ fd 1400 V disc ceramic capacitor between lugs 1 (S-3) and 2 (S-2) of terminal strip N.
  - (✓) C38. Connect a .001  $\mu$ fd disc ceramic capacitor between lugs 1 (S-3) and 2 (S-2) of terminal strip Q.
  - (✓) C37. Connect a .001  $\mu$ fd disc ceramic capacitor from lug 1 of tube socket V1 (S-2) to lug 3 of terminal strip Q (S-2).

SPECIAL NOTICE  
Model HW-30

Please consult your HW-30 Manual and make the following change:

Page 23, column 2, step 2 -

( ) R14. Connect a  $330\ \Omega$  5 watt resistor from lug  $\bullet$  of electrolytic capacitor I (S-4) to lug 2 of terminal strip K (NS). Position away from chassis.

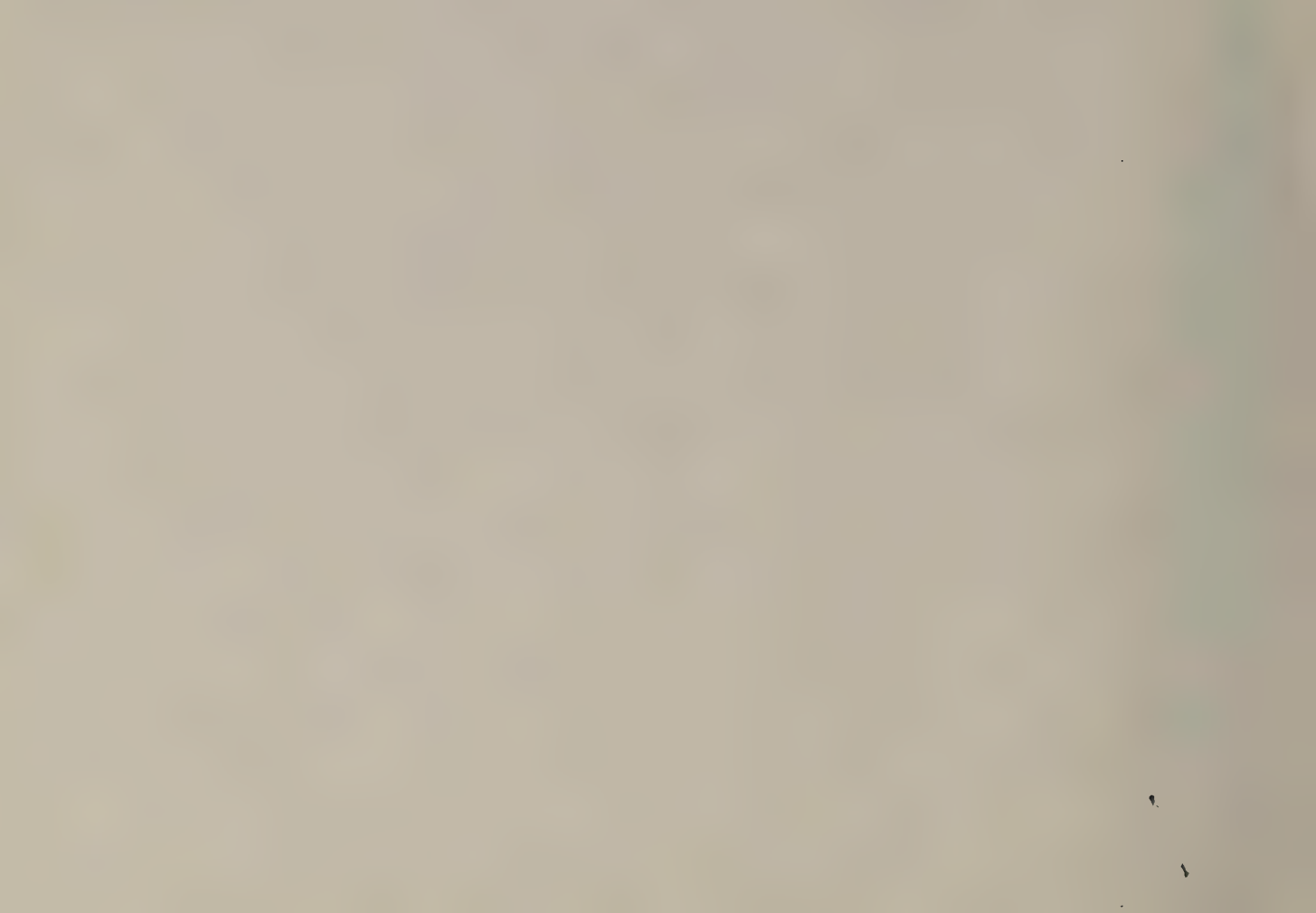
Page 23, Pictorial 9 -

Change the lettering on the resistor to read:  $330\ \Omega$  5 W.

Thank you.

12-8-60

HEATH COMPANY



- (✓) C41. Connect a .001  $\mu$ fd disc ceramic capacitor between lugs 2 (NS) and 3 (S-2) of tube socket V1.
- (✓) C36. Connect a .001  $\mu$ fd disc ceramic capacitor from lug 5 of tube socket V1 (S-2) to lug 2 of terminal strip R (NS).
- (✓) C43. Connect a .001  $\mu$ fd disc ceramic capacitor between lugs 2 (S-4) and 3 (S-4) of terminal strip R.
- (✓) C35. Connect a .01  $\mu$ fd disc ceramic capacitor from lug 6 of tube socket V1 (S-2) to lug 1 of tube socket V2 (S-1).
- (✓) R22. Place a 15/16" length of sleeving over each lead of a 470 K $\Omega$  (yellow-violet-yellow) resistor and connect from lug 7 of tube socket V1 (S-2) to lug 2 of control X (S-1).

### POWER SUPPLY SECTION WIRING

Refer to Pictorial 9 for the following steps.

- (✓) R18. Connect a 470  $\Omega$  2 watt (yellow-violet-brown) resistor from lug  $\Delta$  of electrolytic capacitor I (S-2) to lug 3 of I (S-1).

- (✓) R15. Connect an 8200  $\Omega$  1 watt (gray-red-red) resistor between lugs  $\blacksquare$  (S-2) and  $\blacktriangle$  (NS) of electrolytic capacitor I.

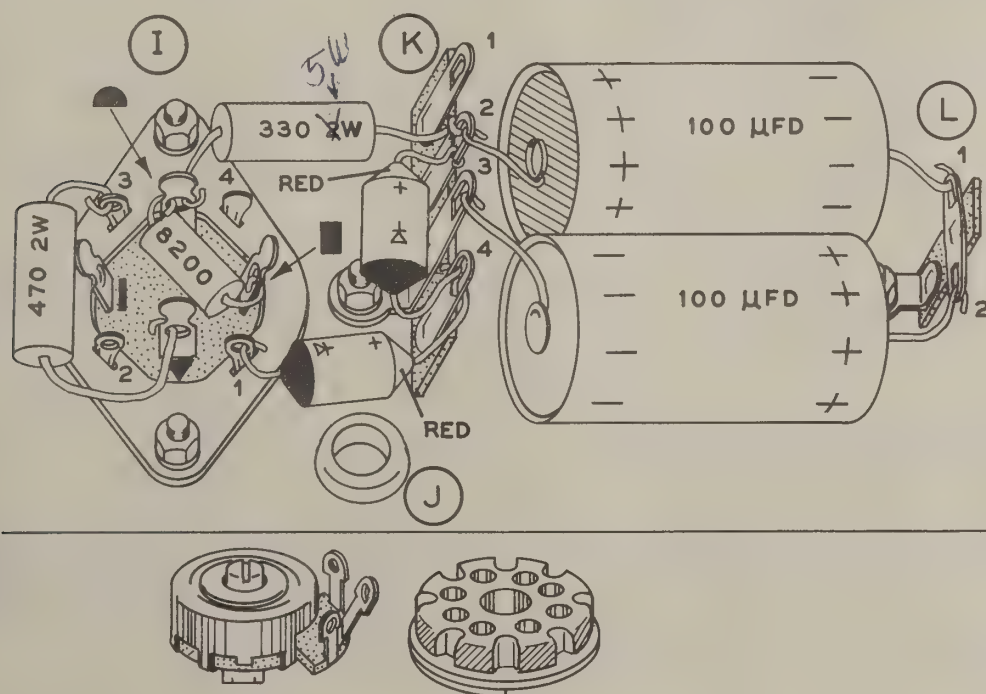
- (✓) R14. Connect a 330  $\Omega$  <sup>5</sup>/<sub>2</sub> watt (orange-orange-brown) resistor from lug  $\blacktriangle$  of electrolytic capacitor I (S-4) to lug 2 of terminal strip K (NS). POSITION AWAY FROM CHASSIS.

- (✓) C31. Connect a 100  $\mu$ fd 200 volt electrolytic capacitor from lug 2 of terminal strip L (S-2) to lug 3 of terminal strip K (S-1). Make sure that the plus (+) end of this capacitor is connected as shown in Pictorial 9.

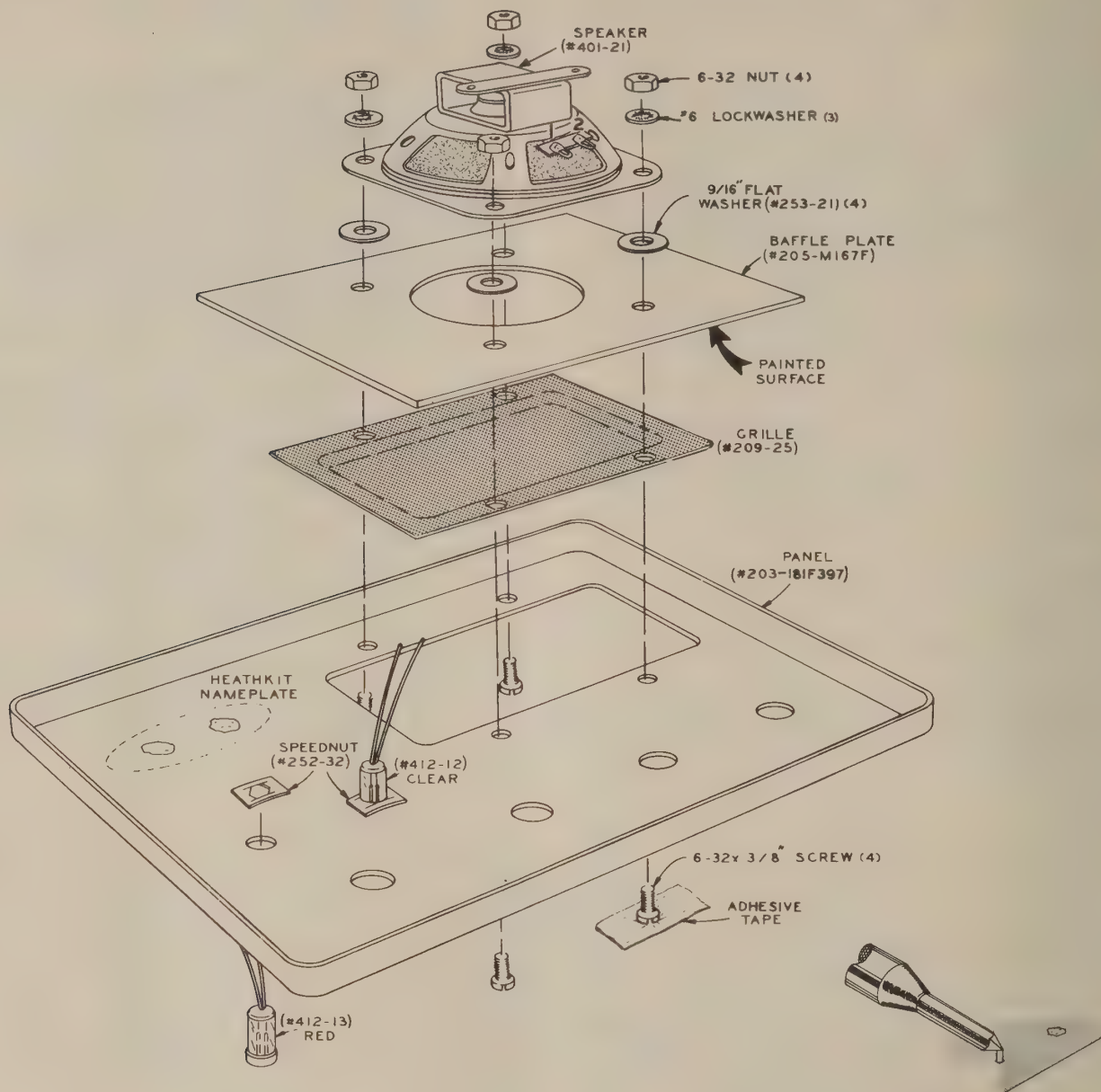
- (✓) C32. Connect the other 100  $\mu$ fd 200 volt electrolytic capacitor from lug 2 of terminal strip K (NS) to lug 1 of terminal strip L (S-1). Be sure the plus (+) end is as shown.

- (✓) Connect a silicon diode from lug 4 of terminal strip K (NS) to lug 1 of filter capacitor I (S-2). Make sure that the red (+) end is shown in Pictorial 9.

- (✓) Connect the other silicon diode from lug 4 of terminal strip K (S-3) to lug 2 of terminal strip K (S-4). Make sure the red (+) end is as shown in Pictorial 9.



Pictorial 9



Pictorial 10

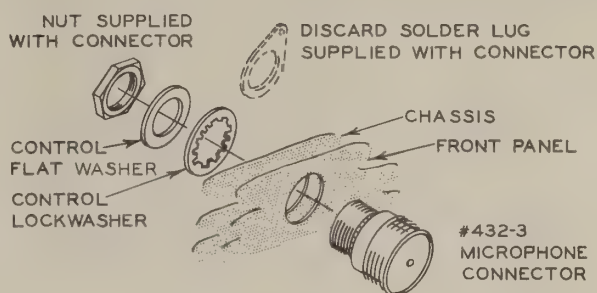
### FRONT PANEL ASSEMBLY AND INSTALLATION

Refer to Pictorial 10 for the following steps.

NOTE: It is recommended that you cover the work area with a soft cloth to prevent scratching the front panel during the following steps.

- (✓) Mount the clear neon pilot lamp at the hole marked POWER, using one of the large speednuts.
- (✓) Similarly, mount the red neon pilot lamp at the hole marked TRANS.
- (✓) Mount the HEATHKIT nameplate at the two holes above the words "THE TWOER." Melt the pins of the nameplate with a soldering iron and press them against the back of the panel.
- (✓) Locate four 6-32 x 3/8" screws. Place each one through a speaker mounting hole and temporarily fasten them there with adhesive tape over the heads.

- (✓) Place the panel face down on the work area and assemble the speaker to the panel as follows:
- (✓) Place the grill over the screws so that it protrudes through the front panel, with the openings in the mesh facing toward the bottom edge of the panel.
- (✓) Place the baffle over the screws with the black surface toward the grill.
- (✓) Place one of the 9/16" flat washers over each screw.
- (✓) Now, install the speaker. Position it as shown in Pictorial 10. Place a #6 lockwasher and 6-32 nut on each of the screws. Carefully center the speaker grill in the opening and tighten all nuts.
- (✓) Place the chassis such that it rests on the rear apron, power transformer and filter capacitor.
- (✓) Remove the nuts and flat washers from switch Z, control X, and capacitor Y.
- (✓) Place the front panel in position over the three bushings and install a flat washer and nut on each bushing. Do not tighten yet. Make sure that the leads from the neon pilot lamps are not caught between the panel and chassis.
- (✓) Install the microphone connector at W. Place the connector through the front of the panel. Install a control lockwasher, a control flat washer and nut on the connector inside the chassis and tighten securely. See Detail 10A.
- (✓) Now, tighten the control, capacitor and switch mounting nuts. Hold the components so that they do not turn.

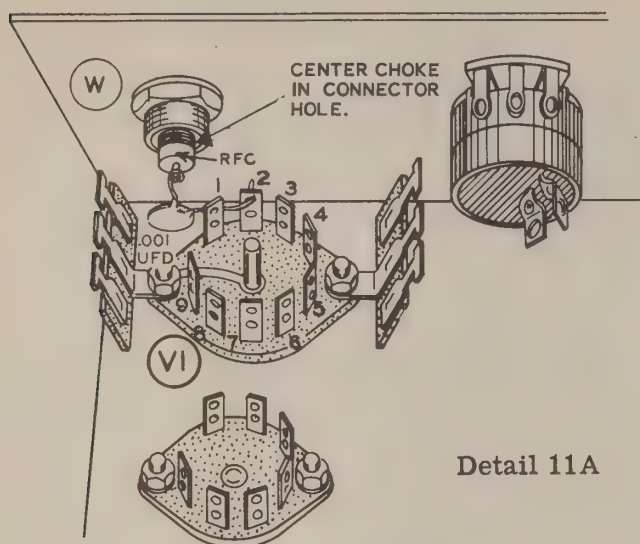


Detail 10A

### FINAL WIRING ABOVE CHASSIS

Refer to Pictorial 11 (fold-out from Page 31) for the following steps.

- (✓) Connect a length of hookup wire from lug 1 of the speaker (S-1) to the solder lug at location P (S-1).
- (✓) Connect the lead coming from lug 3 of switch Z to lug 3 of terminal strip AA (NS).
- (✓) Connect the lead coming from lug 2 of switch Z to lug 2 of terminal strip AA (NS).
- (✓) Connect one lead of the red neon pilot lamp to lug 1 of terminal strip AA (NS).
- (✓) Connect the other lead to the hole in the mounting foot of terminal strip AA (NS). Use sleeving on this lead.
- (✓) Connect one lead of the clear neon pilot lamp to lug 4 of terminal strip AA (NS).
- (✓) Connect the other lead to the hole in the mounting lug of terminal strip AA (S-2). Use sleeving on this lead.
- (✓) R25. Connect a 150 K $\Omega$  (brown-green-yellow) resistor between lugs 1 (S-2) and 2 (S-2) of terminal strip AA.
- (✓) R16. Connect another 150 K $\Omega$  (brown-green-yellow) resistor between lugs 3 (S-2) and 4 (S-2) of terminal strip AA.
- (✓) Connect the remaining lead from the audio output transformer to lug 2 of the speaker (S-1).



Detail 11A

### FINAL WIRING BELOW CHASSIS

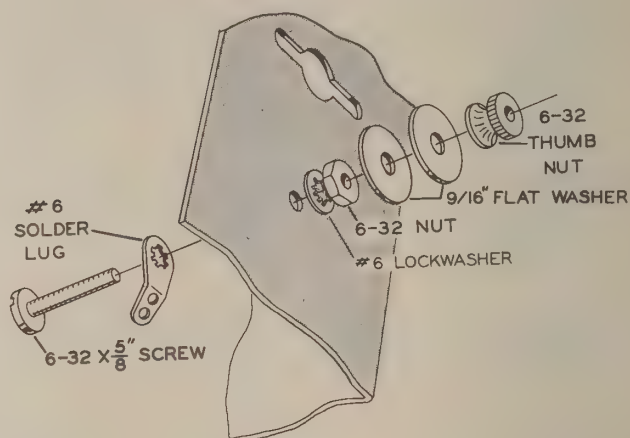
Refer to Detail 11A for the following steps.

- (✓) Connect an RF choke to the center of the microphone connector. Place the body of the choke in the center of the connector as shown. Solder the choke in place.
- (✓) Cut the lead on the other end of the choke to 1/8".
- (✓) C40. Connect a .001 μfd disc ceramic capacitor from lug 2 of tube socket V1 (S-3) to the 1/8" lead of the RF choke (S-1).

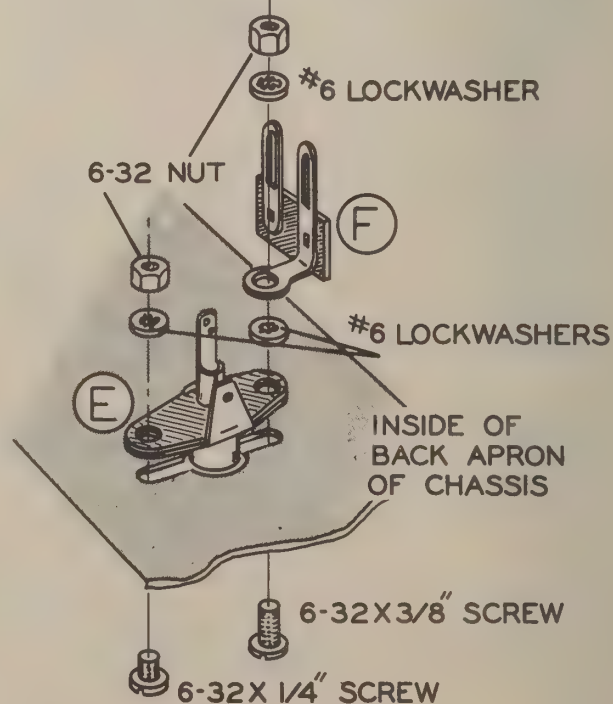
Refer to Pictorial 12 for the following steps.

- (✓) Mount a #6 solder lug at location D. Use a 6-32 x 5/8" screw. Place two flat washers on the screw and secure with the 6-32 thumb-nut. Note sequence of hardware in Detail 12A.
- (✓) Mount the phono socket E and 2-lug terminal strip F. Use a 6-32 x 3/8" screw, #6 lockwasher and 6-32 nut for the double mounting as shown in Detail 12B.
- (✓) Mount the phone jack at location G. Use a control lockwasher, control flat washer and nut.
- (✓) Connect an RF choke (#45-37) from lug 1 of phono socket E (NS) to solder lug D (S-1). See Pictorial 12.

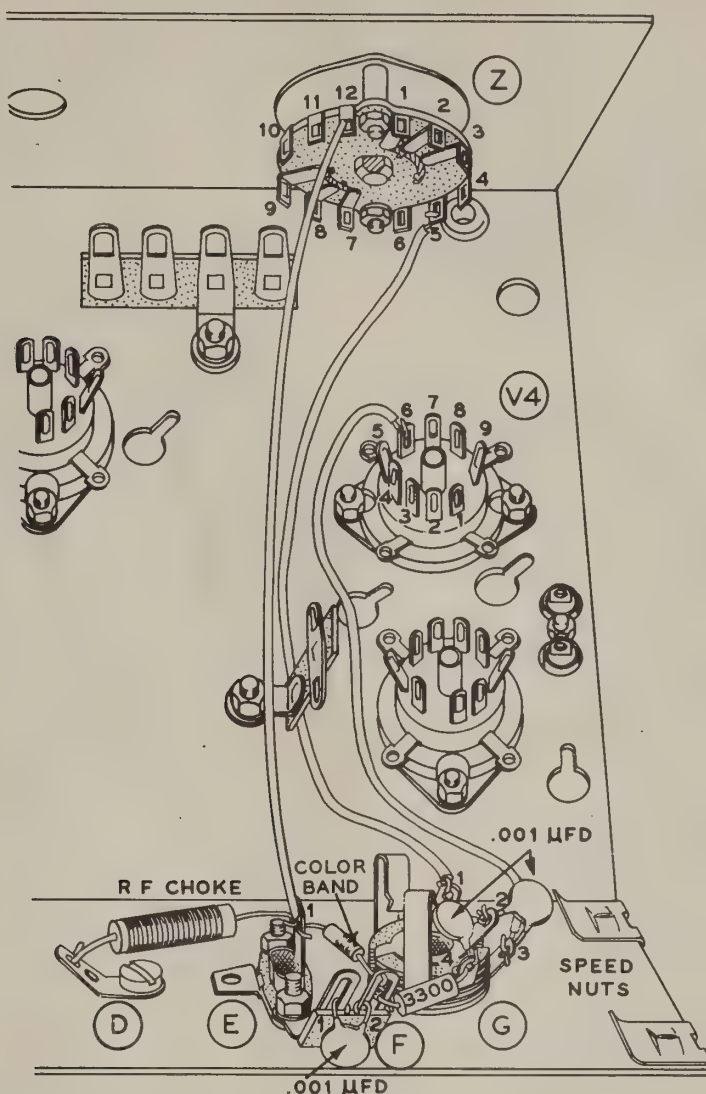
- (✓) C19. Connect a .001 μfd disc ceramic capacitor between lugs 2 (NS) and 4 (NS) of phone jack G.
- (✓) C42. Connect a .001 μfd disc ceramic capacitor between lugs 2 (S-2) and 3 (NS) of phone jack G.
- (✓) C18. Connect another .001 μfd disc ceramic capacitor between lugs 1 (S-1) and 2 (NS) of terminal strip F.
- (✓) R8. Connect a 3300 Ω (orange-orange-red) resistor from lug 2 of terminal strip F (NS) to lug 4 of phone jack G (S-2).



Detail 12A



Detail 12B



Pictorial 12

- (✓) Connect a 5" wire from lug 1 of phone jack G (S-1) to lug 5 of switch Z (S-1).
- (✓) Connect a 5" wire from lug 3 of phone jack G (S-2) to lug 6 of tube socket V4 (S-2).
- (✓) Connect a length of heavy bare wire from lug 1 of phono socket E (NS) to lug 12 of switch Z (S-1). Provide a slight amount of slack in this wire to prevent damage to switch Z when the rear chassis apron is pulled back against the inside rear of the cabinet.
- (✓) Connect the crystal diode with the color bands toward lug 2 of terminal strip F, to lug 2 of F (S-3). Connect the other lead of the crystal diode to lug 1 of phono socket E

(S-3). Use care when soldering the connections concerning the diode, since it can be damaged by excessive heat. A heat sink can be made by gripping the lead between the diode body and the solder connection with long-nose pliers.

- (✓) Install a speednut at each corner of the chassis back apron. Be sure that the flat side is facing outward, See Pictorial 12.
- (✓) Install the lever knob on the TRANSMIT-RECEIVE switch.
- (✓) Install the other knobs on the TUNING shaft and the VOLUME control shaft.

Set this assembly aside for the moment and proceed with the assembly of the cabinet and cables.

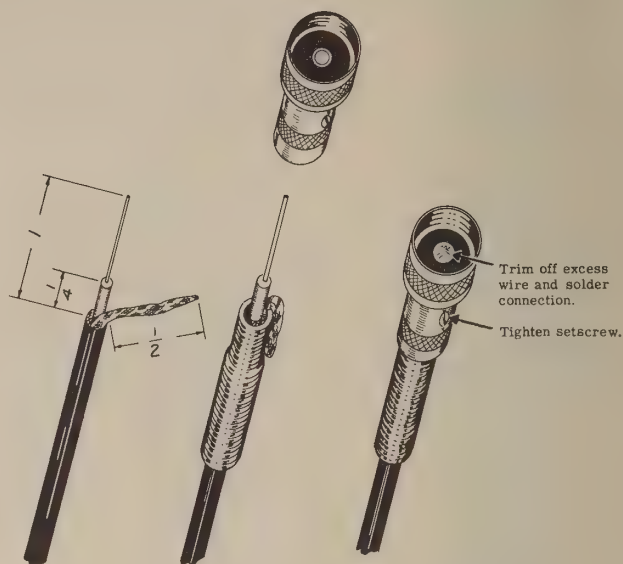
## FINAL ASSEMBLY

CABINET

- (✓) Assemble the handle to the cabinet with the two large self-tapping screws.
- (✓) Mount the four rubber feet from the outside of the cabinet in the four holes in the cabinet bottom

MICROPHONE CABLE

- (✓) Using Figure 1, install the microphone connector (#432-1) on the microphone cable.

AC POWER CORDAC POWER CORD

Refer to Figure 2 for the following steps.

- (✓) Slide an octal plug cap (#440-1) over the line cord, grommet end first.
- (✓) Tie a large double knot in the cord to act as a strain relief.
- (✓) Connect one lead of the line cord to an octal socket (#434-4) lug 8 (S-1). Connect the other lead to lug 6 (S-1).
- (✓) Connect a bare lead from lug 4 (S-1) to lug 3 (S-1).
- (✓) Connect another bare lead from lug 2 (S-1) to lug 1 (S-1).
- (✓) Snap the cap over the socket.
- (✓) Check the line cord and socket pins with an ohmmeter to be sure no connections exist between socket pins other than those shown.

Figure 1

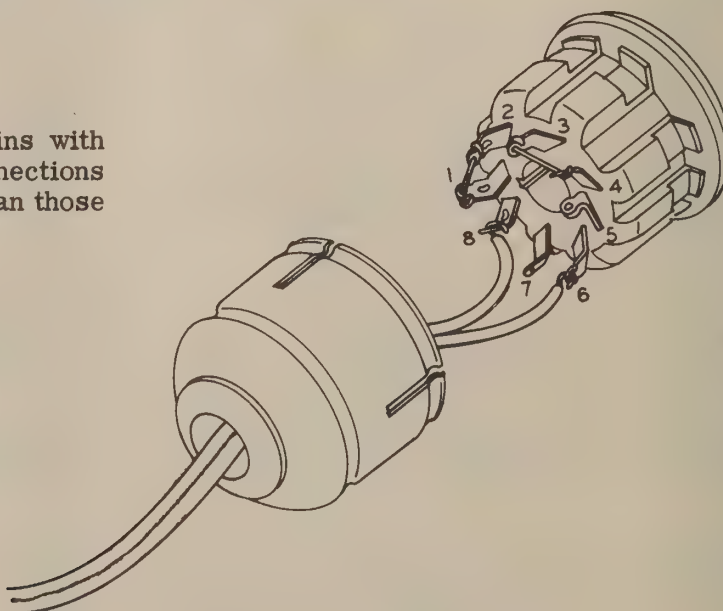


Figure 2

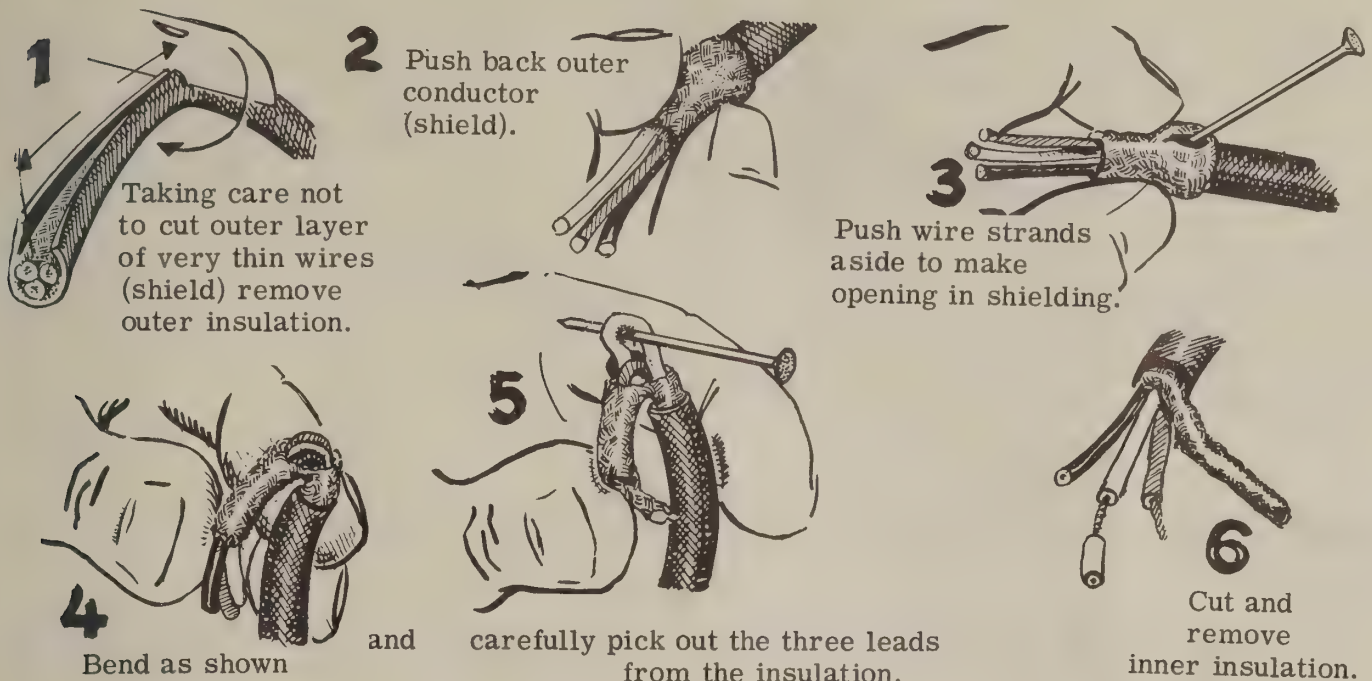


Figure 3

## CONNECTING CABLES

### EXTERNAL POWER SUPPLY CABLE

Refer to Figure 3.

- ( ) Using care to not cut the shield wires, remove 3" of the outer jacket from the 3-conductor shielded cable. Strip 3/4" of the jacket from the other end.
- ( ) On both ends of the cable, break the leads out the side of the shield braid, as shown in Figure 3.

( ) Strip all the leads 1/4".

- ( ) Pull the slack out of the shield braid pig-tails and cut them to the same length as the black leads at both ends of the cable.

**NOTE:** Determine the voltage on which this cable is to operate. If the source is 12 volts, use the first group of steps; if the source is 6 volts, use the second group of steps following this note.

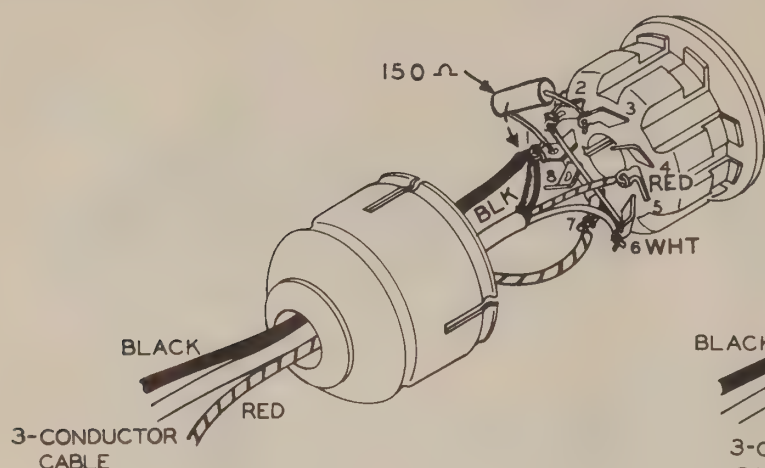


Figure 4

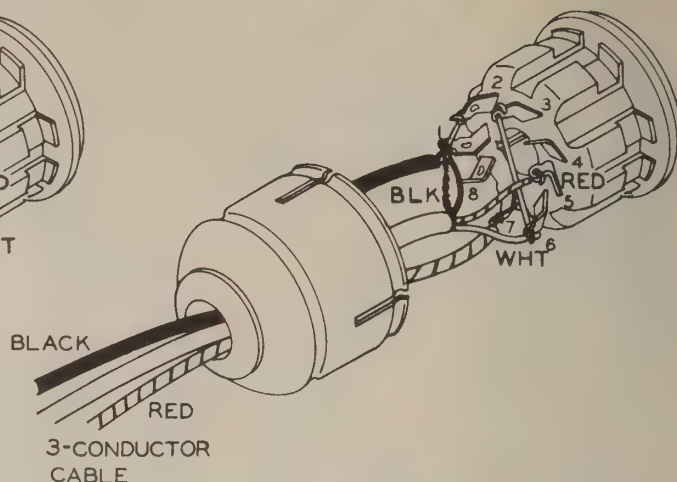


Figure 5

### CONNECTIONS FOR 12 VOLT OPERATION

Refer to Figure 4.

- ( ) Feed the 3/4" end of the cable through the octal plug cap from the grommet side.
- ( ) Strip the heavy red and black leads 5/8" on one end and 1/4" on the other. Tin the leads. Pass the ends stripped 1/4" through the octal plug cap where they will be used in the following steps. The ends stripped 5/8" are for connection to the power source.
- ( ) Connect the heavy red lead to lug 7 of the octal socket (#434-4) (S-1).
- ( ) Connect the small red lead from the shielded cable to lug 5 of the socket (S-1).
- ( ) Connect both black leads and the shield pigtail to lug 1 (NS).
- ( ) Connect a 150 Ω (brown-green-brown) resistor between lugs 1 (S-4) and 3 (S-1).
- ( ) Connect the white lead to lug 6 (NS).
- ( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 2 (S-1). Use sleeving.

### CONNECTIONS FOR 6 VOLT OPERATION

Refer to Figure 5.

- ( ) Feed the 3/4" end of the cable through the octal plug cap from the grommet side.
- ( ) Strip the heavy red and black leads 5/8" on one end and 1/4" on the other. Tin the leads. Pass the ends stripped 1/4" through the octal plug cap where they will be used in the following steps. The ends stripped 5/8" are for connection to the power source.
- ( ) Connect the heavy red lead to lug 7 of the octal socket (#434-4) (S-1).
- ( ) Connect the small red lead from the shielded cable to lug 5 of the socket (S-1).
- ( ) Connect both black leads and the shield pigtail to lug 1 (NS).
- ( ) Connect a bare wire from lug 1 (S-4) to lug 2 (S-1).
- ( ) Connect the white lead to lug 6 (NS).
- ( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 3 (S-1). Use sleeving.

NOTE: The 150 Ω (brown-green-brown) resistor is used for 12 volt operation only and will otherwise not be used.

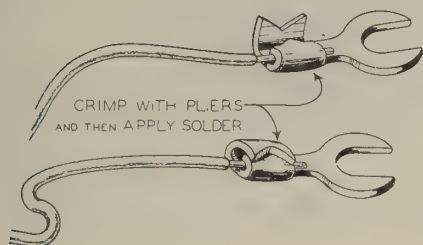


Figure 6

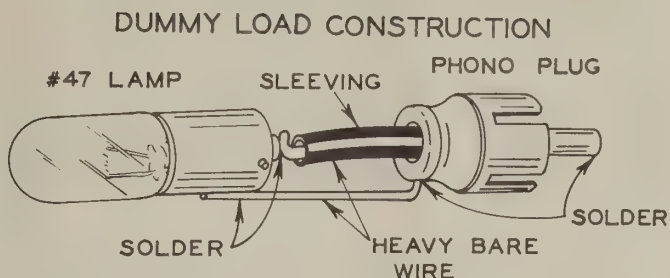


Figure 7

Check the connections just completed on the socket and when you are sure no shorts exist, snap the cap over the socket (if in doubt, tape connections). It might be wise to put a piece of tape on the outside of the shell with the operating voltage of the cable plainly marked for future reference.

- ( ) Refer to Figure 6 and at the 3" stripped end of the cable install spade terminals on the red and white leads. Connect both the black lead and the shield pigtail to the remaining spade terminal in similar manner.

#### DUMMY LOAD

- (✓) Construct the dummy load by carefully following Figure 7.

NOTE: Use care in soldering to the solder blob at the tip of the #47 lamp to avoid damaging the lamp.

It might be wise to now recheck the HW-30 wiring once more against the Pictorials to be sure that everything is correct. Shake out any wire clippings or solder splashes which might be in the chassis. Now proceed with the test and calibration of the unit as stated in the following pages of the manual.

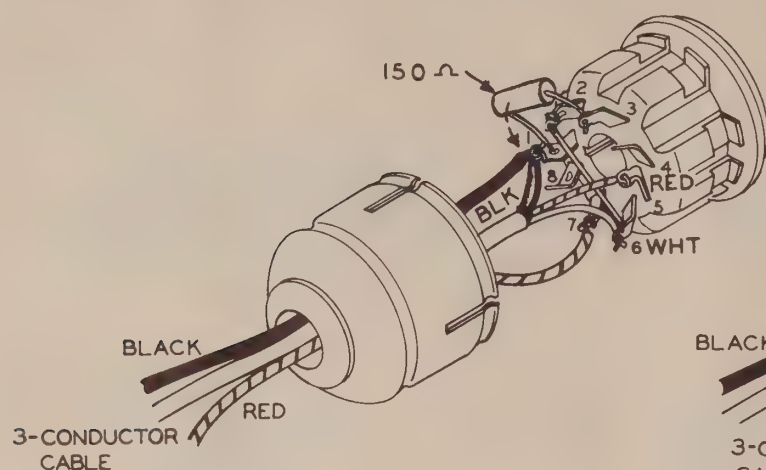


Figure 4

### CONNECTIONS FOR 12 VOLT OPERATION

Refer to Figure 4.

- ( ) Feed the 3/4" end of the cable through the octal plug cap from the grommet side.
- ( ) Strip the heavy red and black leads 5/8" on one end and 1/4" on the other. Tin the leads. Pass the ends stripped 1/4" through the octal plug cap where they will be used in the following steps. The ends stripped 5/8" are for connection to the power source.
- ( ) Connect the heavy red lead to lug 7 of the octal socket (#434-4) (S-1).
- ( ) Connect the small red lead from the shielded cable to lug 5 of the socket (S-1).
- ( ) Connect both black leads and the shield pigtail to lug 1 (NS).
- ( ) Connect a 150 Ω (brown-green-brown) resistor between lugs 1 (S-4) and 3 (S-1).
- ( ) Connect the white lead to lug 6 (NS).
- ( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 2 (S-1). Use sleeving.

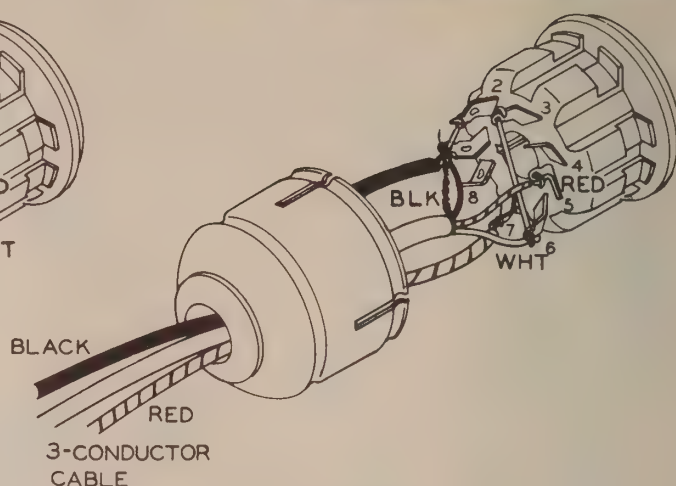


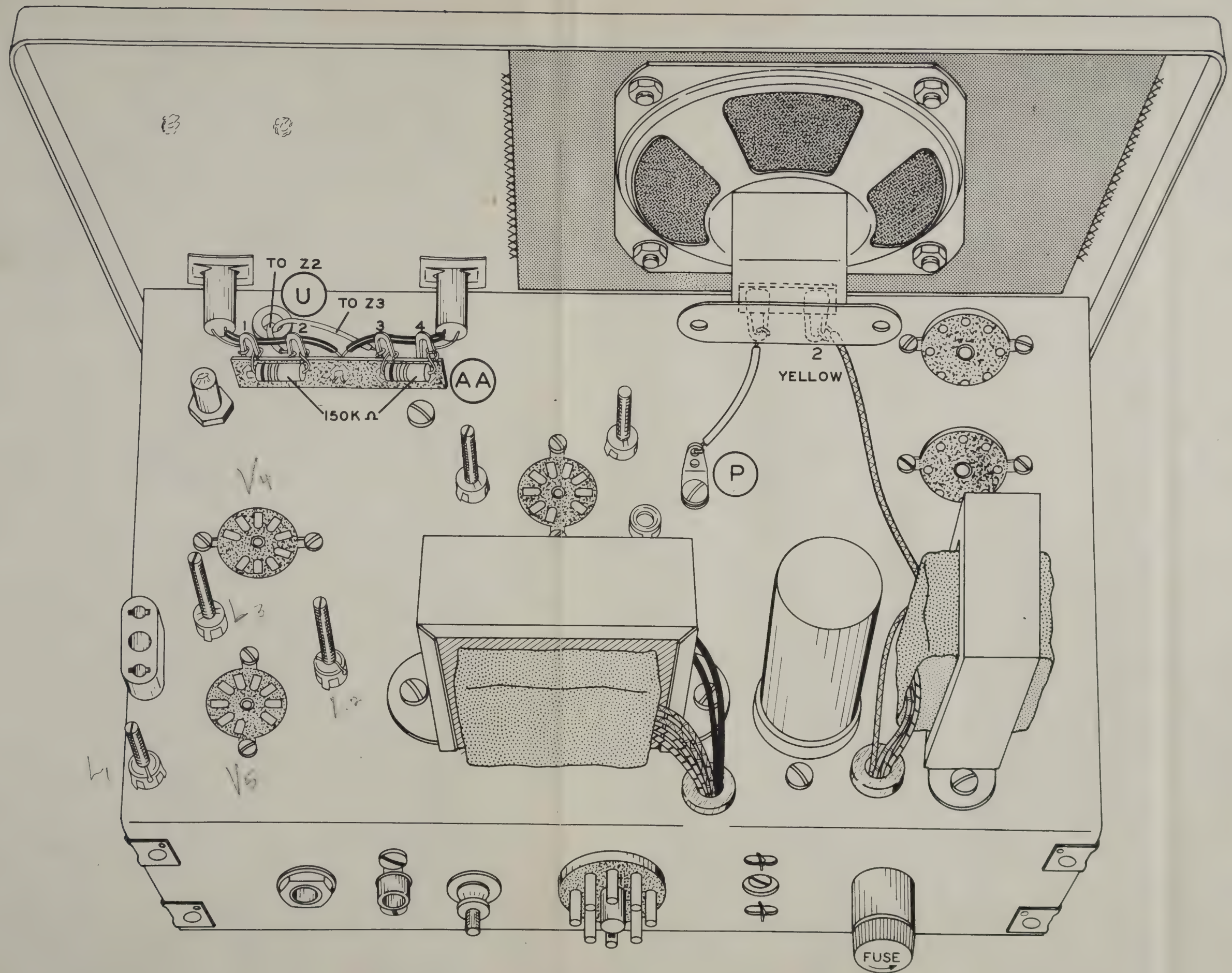
Figure 5

### CONNECTIONS FOR 6 VOLT OPERATION

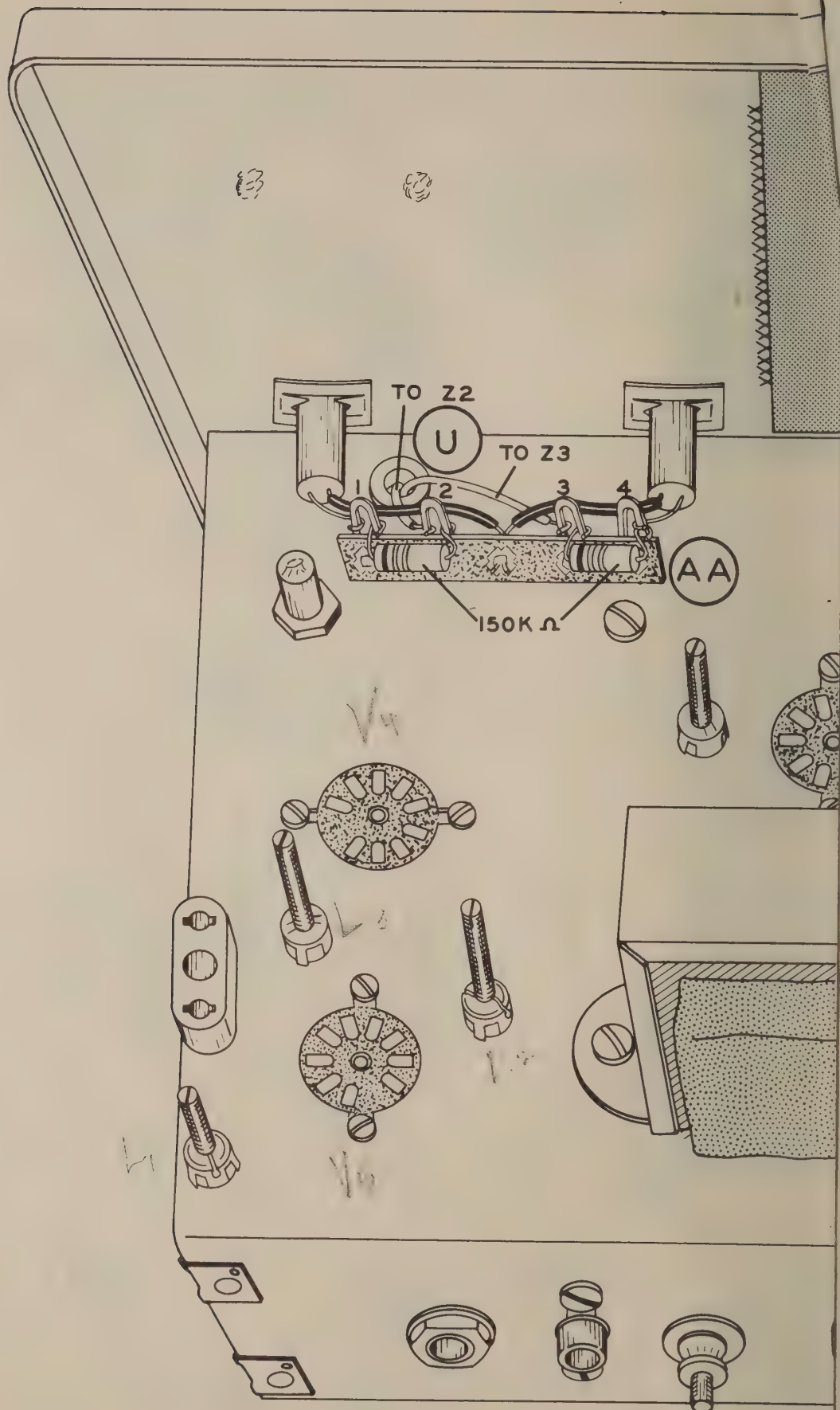
Refer to Figure 5.

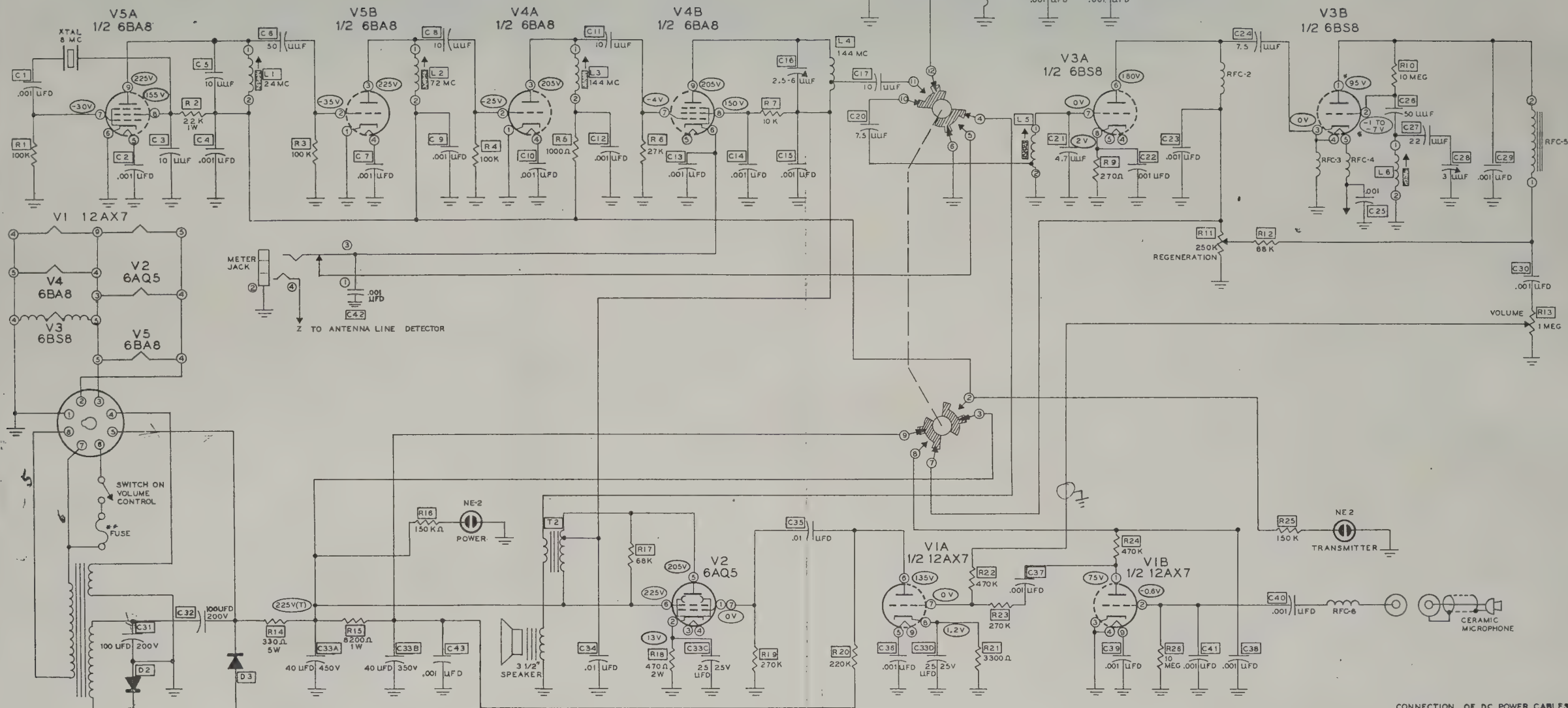
- ( ) Feed the 3/4" end of the cable through the octal plug cap from the grommet side.
- ( ) Strip the heavy red and black leads 5/8" on one end and 1/4" on the other. Tin the leads. Pass the ends stripped 1/4" through the octal plug cap where they will be used in the following steps. The ends stripped 5/8" are for connection to the power source.
- ( ) Connect the heavy red lead to lug 7 of the octal socket (#434-4) (S-1).
- ( ) Connect the small red lead from the shielded cable to lug 5 of the socket (S-1).
- ( ) Connect both black leads and the shield pigtail to lug 1 (NS).
- ( ) Connect a bare wire from lug 1 (S-4) to lug 2 (S-1).
- ( ) Connect the white lead to lug 6 (NS).
- ( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 3 (S-1). Use sleeving.

NOTE: The 150 Ω (brown-green-brown) resistor is used for 12 volt operation only and will otherwise not be used.



Pictorial 11





**NOTE:**

ALL RESISTANCES IN OHMS K = 1000.  
 ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.  
 ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS GROUND.  
 VOLTAGES TAKEN WITH AN 11 MEGOHM VTVM.  
 ALL VOLTAGES POSITIVE UNLESS OTHERWISE SPECIFIED.

VOLTAGE READINGS TAKEN WITH UNIT OPERATING FROM NOMINAL 117 VOLT AC LINE WITH DUMMY LOAD PLUGGED IN AND CONTROLS SET AS FOLLOWS:

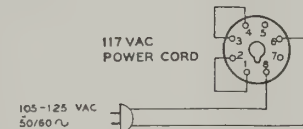
|                  |                                 |      |
|------------------|---------------------------------|------|
| VOLUME CONTROL   | - ANY POSITION                  | - ON |
| TUNING CAPACITOR | - ANY POSITION                  |      |
| REGENERATION     | - ADJUSTED FOR NORMAL RECEPTION |      |
| MICROPHONE       | - DISCONNECTED                  |      |

READINGS ON V1, V2, V4 AND V5 WITH SWITCH IN TRANSMIT.  
 READINGS ON V3 WITH SWITCH IN RECEIVE.

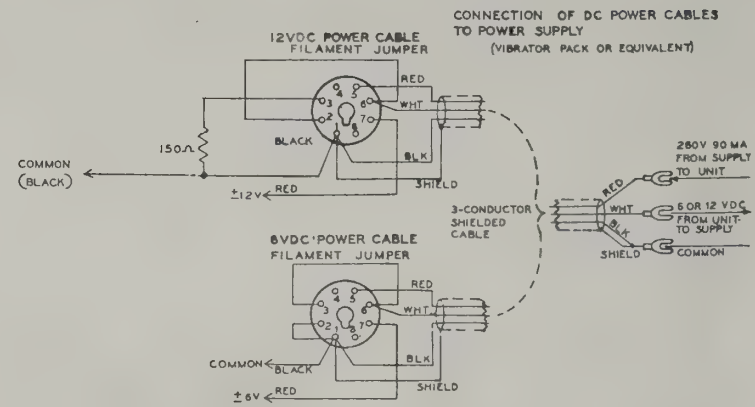
PRESENCE OF METER PROBE IN TRANSMITTER SECTION WILL CAUSE DE-TUNING IN MANY CASES. VALUES SHOWN ARE APPROXIMATE ONLY AND DEPENDENT UPON TUNING AND CRYSTAL ACTIVITY.

\* VARIES WITH TUNING AND R11 SETTING.

\*\* 1-1/2 AMP FOR AC OPERATION.  
 8 AMP FOR EXTERNAL POWER SUPPLY OPERATION.



## 2 METER AMATEUR TRANSCEIVER MODEL HW-30



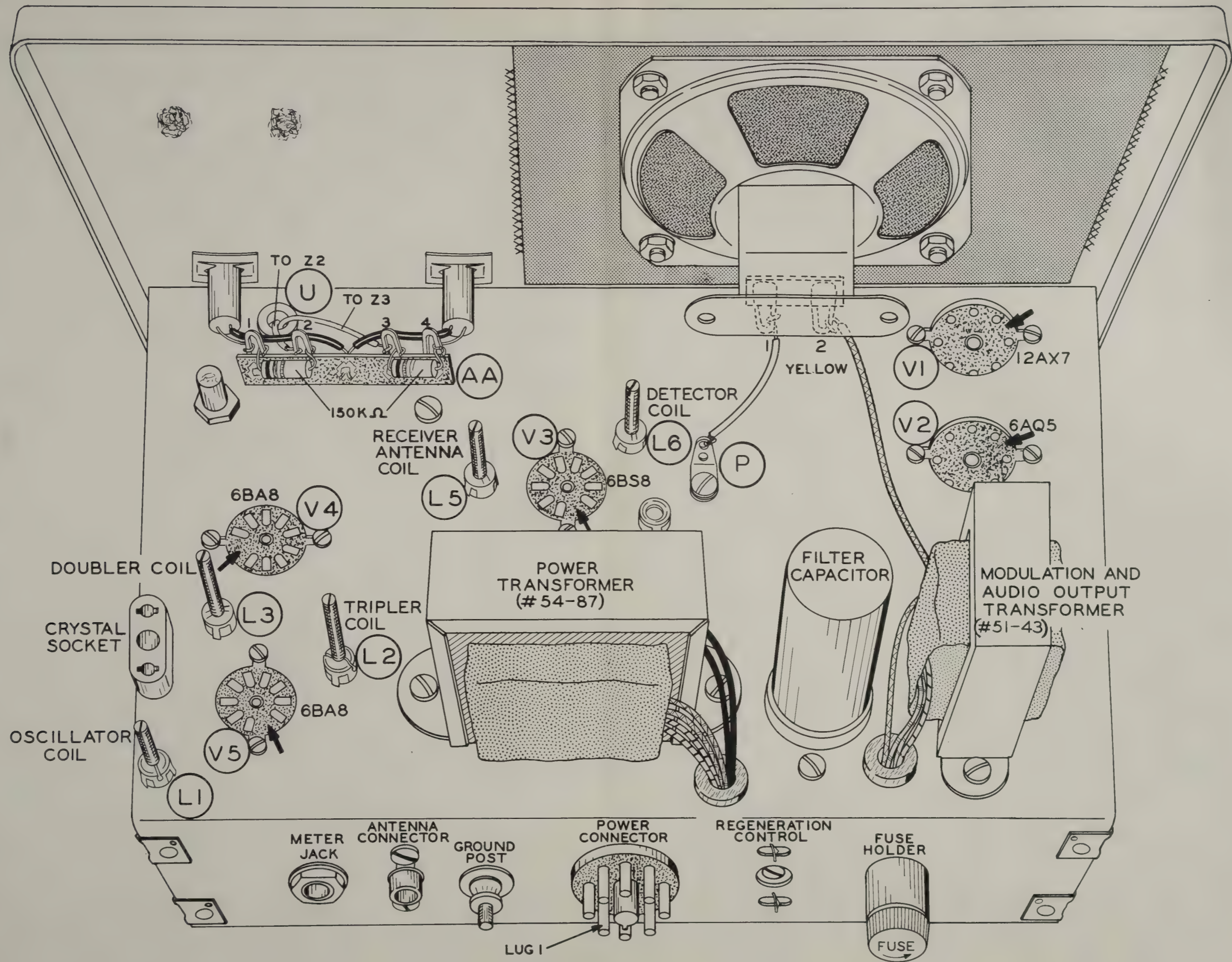
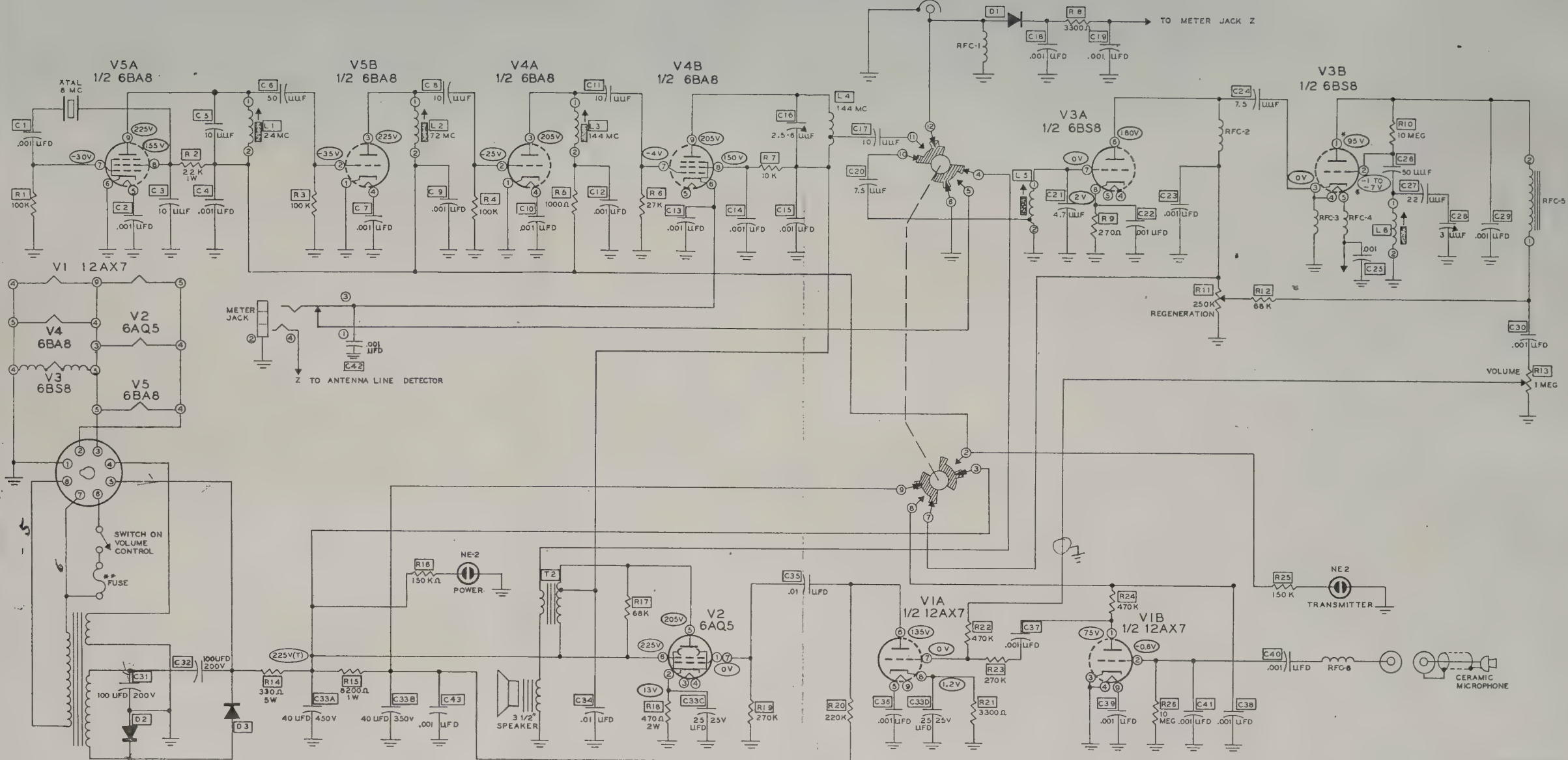


Figure 8



# NOTE:

ALL RESISTANCES IN OHMS K = 1000.  
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.  
ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS GROUND.  
VOLTAGES TAKEN WITH AN 11 MEGOHM VTVM.  
ALL VOLTAGES POSITIVE UNLESS OTHERWISE SPECIFIED.

VOLTAGE READINGS TAKEN WITH UNIT OPERATING FROM NOMINAL 117 VOLT AC LINE WITH DUMMY LOAD PLUGGED IN AND CONTROLS SET AS FOLLOWS:

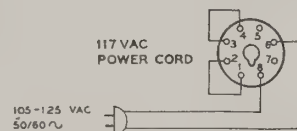
VOLUME CONTROL - ANY POSITION - ON  
TUNING CAPACITOR - ANY POSITION  
REGENERATION - ADJUSTED FOR NORMAL RECEPTION  
MICROPHONE - DISCONNECTED

READINGS ON V1, V2, V4 AND V5 WITH SWITCH IN TRANSMIT.  
READINGS ON V3 WITH SWITCH IN RECEIVE.

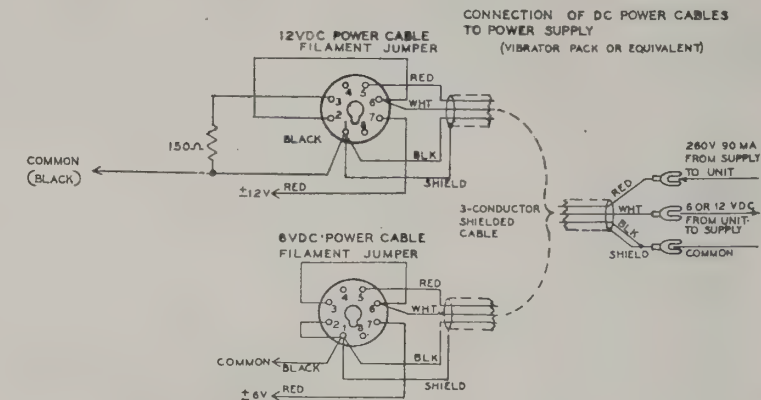
PRESENCE OF METER PROBE IN TRANSMITTER SECTION WILL CAUSE DE-TUNING IN MANY CASES. VALUES SHOWN ARE APPROXIMATE ONLY AND DEPENDENT UPON TUNING AND CRYSTAL ACTIVITY.

\* VARIES WITH TUNING AND R11 SETTING.

\*\* 1-1/2 AMP FOR AC OPERATION.  
8 AMP FOR EXTERNAL POWER SUPPLY OPERATION.



## 2 METER AMATEUR TRANSCEIVER MODEL HW-30

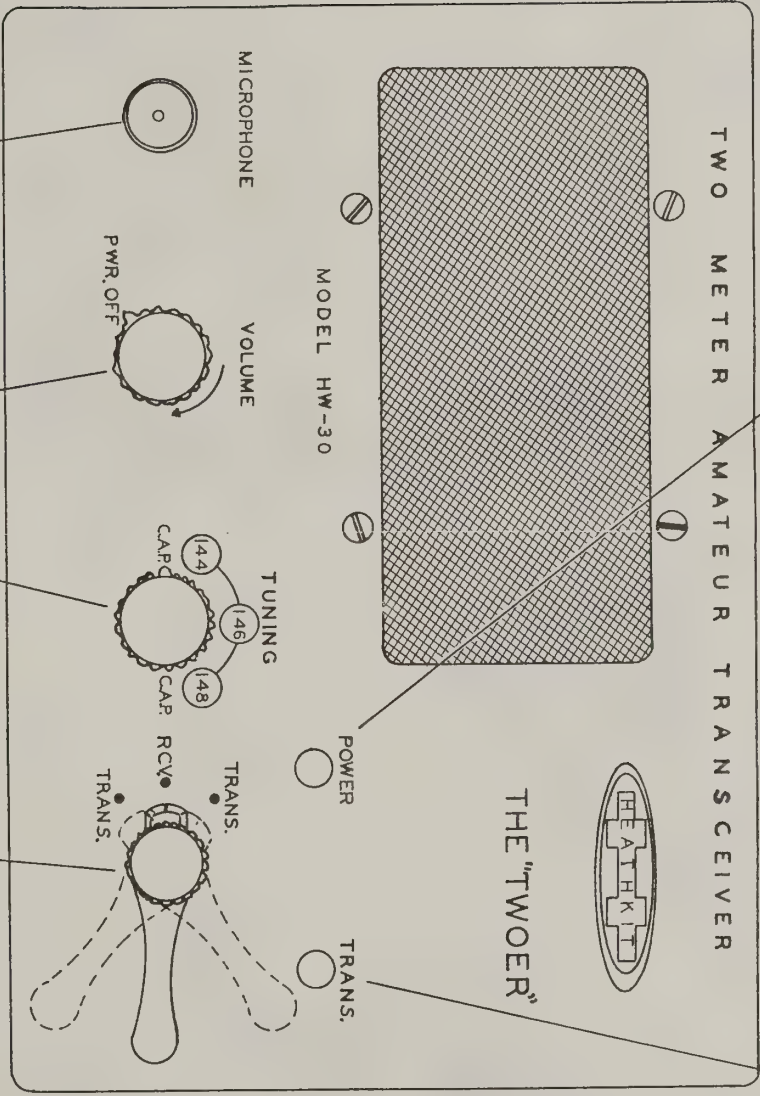




CONTROL FUNCTIONS

Power Indicator. Informs the operator when power is applied to the unit.

Trans. Indicator. Informs the operator that the unit is on transmit by indicating the presence of B+ in the transmitter section.



Microphone Connector. The electrical connections between the microphone and unit are made via this connector, to permit removal of the microphone as desired.

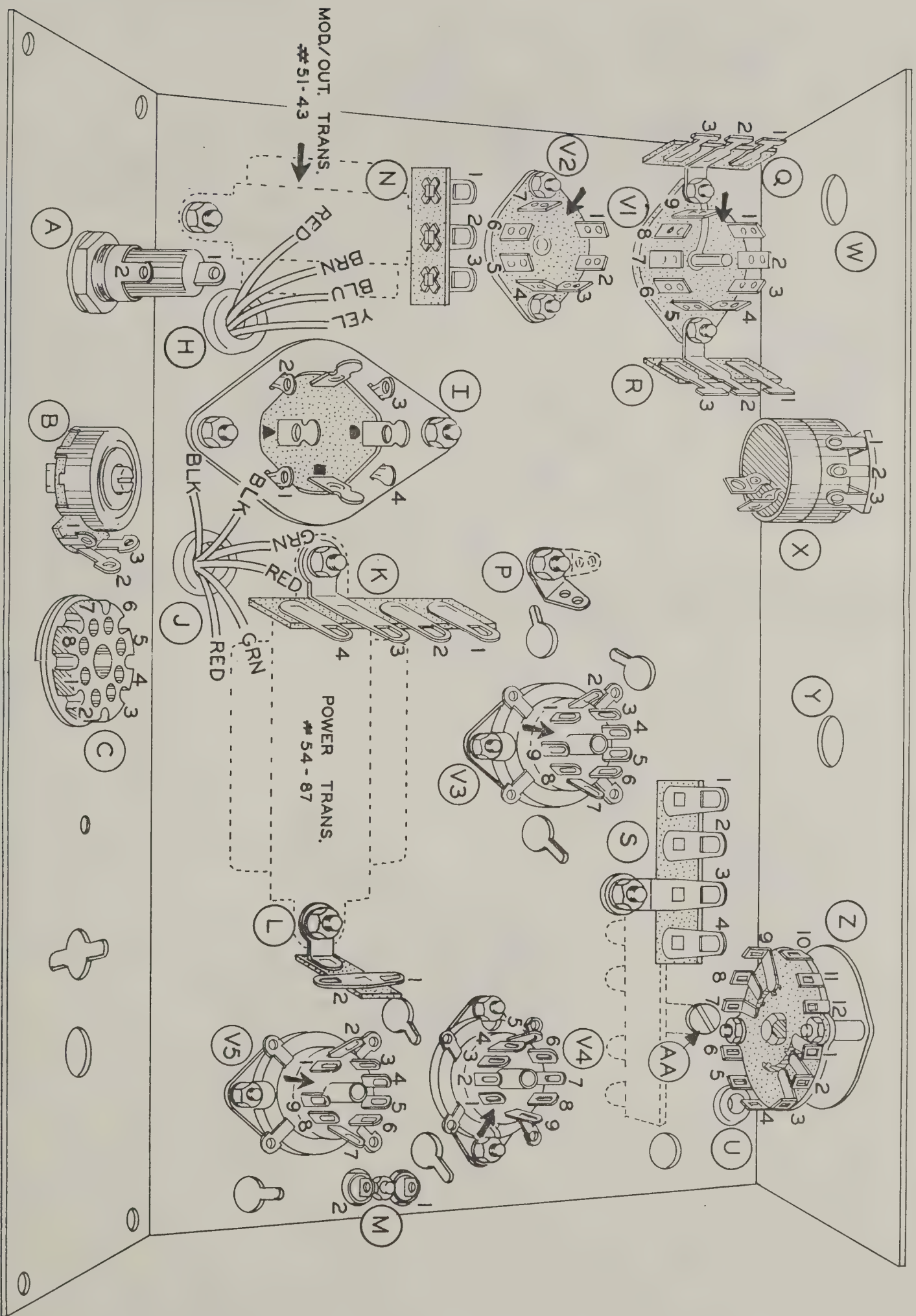
VOLUME Control. Permits varying the sound output from the speaker to suit your individual desire. A switch at the counterclockwise end of rotation disconnects the unit from its power source.

TUNING Control. Permits the receiver to be tuned at will. Note that this control has NO effect on transmitter frequency. A

TRANSMT-RECEIVE Switch. The middle, or RECEIVE position actuates the receiver section of the HW-30. Pushing the knob down permits short transmissions of an intermittent nature, and is comparable to a similar function provided in many intercoms. Lifting up allows continuous transmission for longer periods of time without continuous pressure. This position would normally be used primarily for mobile operation. Both TRANSMT positions perform the same functions electrically.

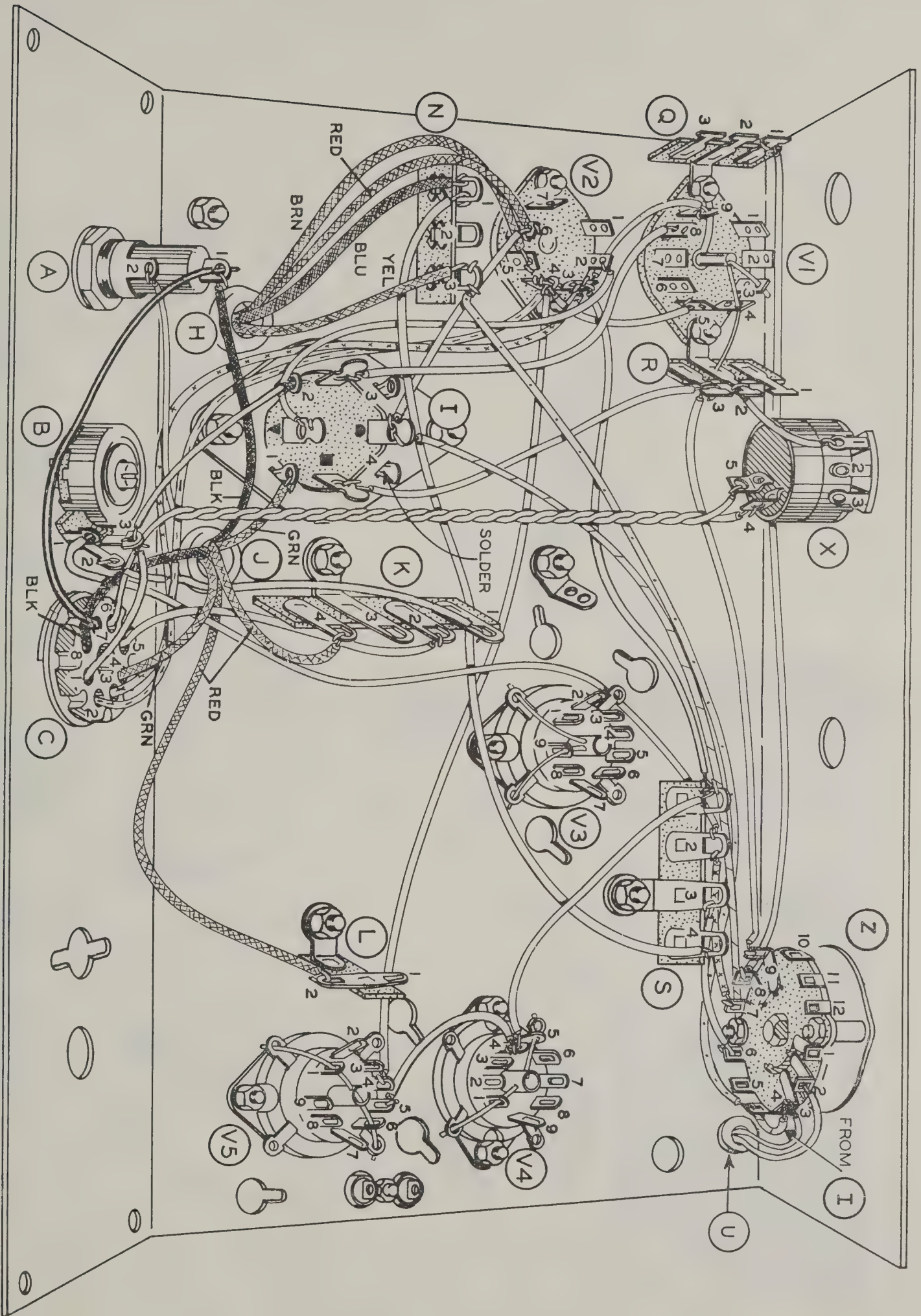
Handwritten notes and sketches at the bottom of the page, including the number '52-72' and a signature.





Pictorial 1





Pictorial 2



800.7  
 18  
 16405-6  
 18007  
 14913.6

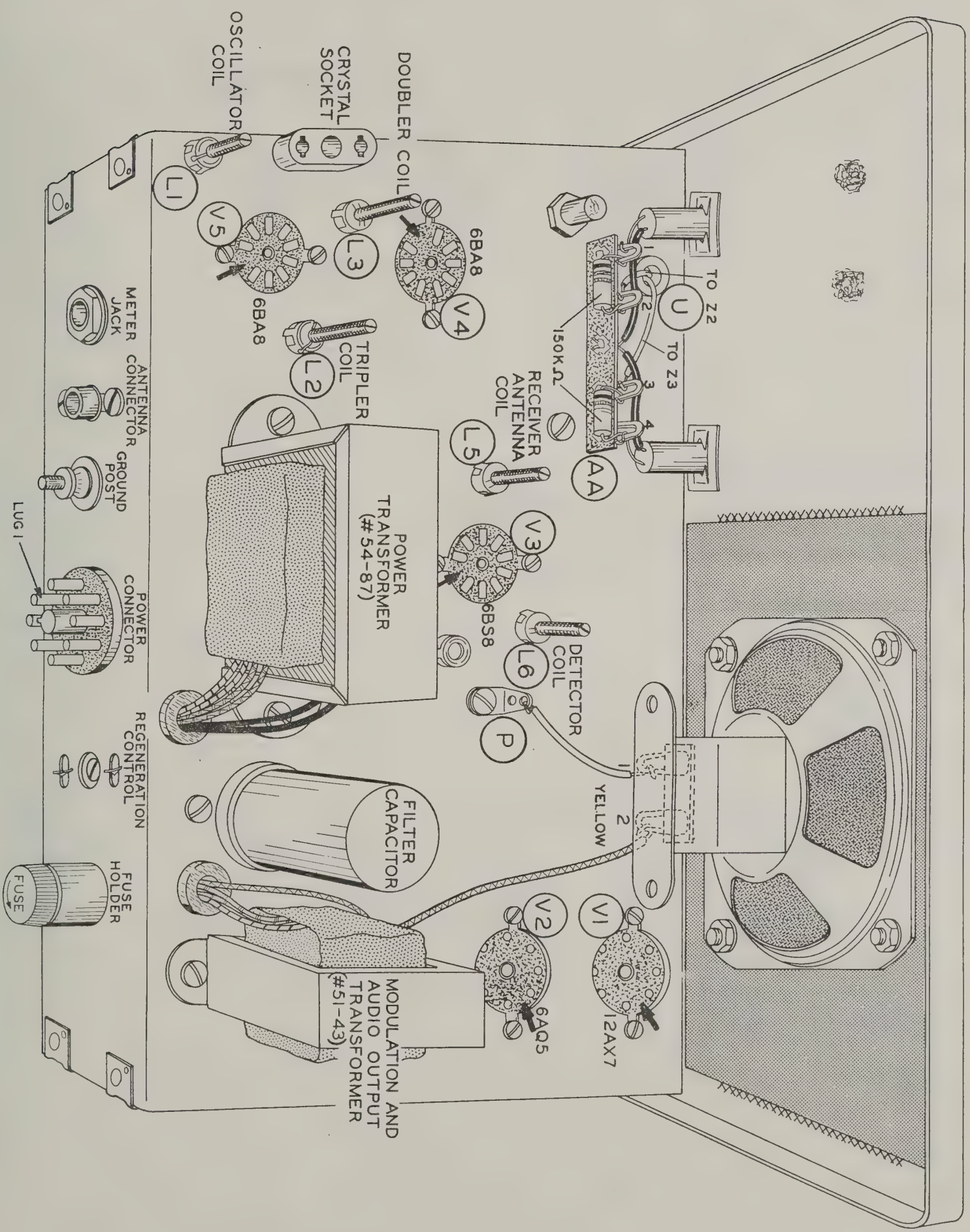
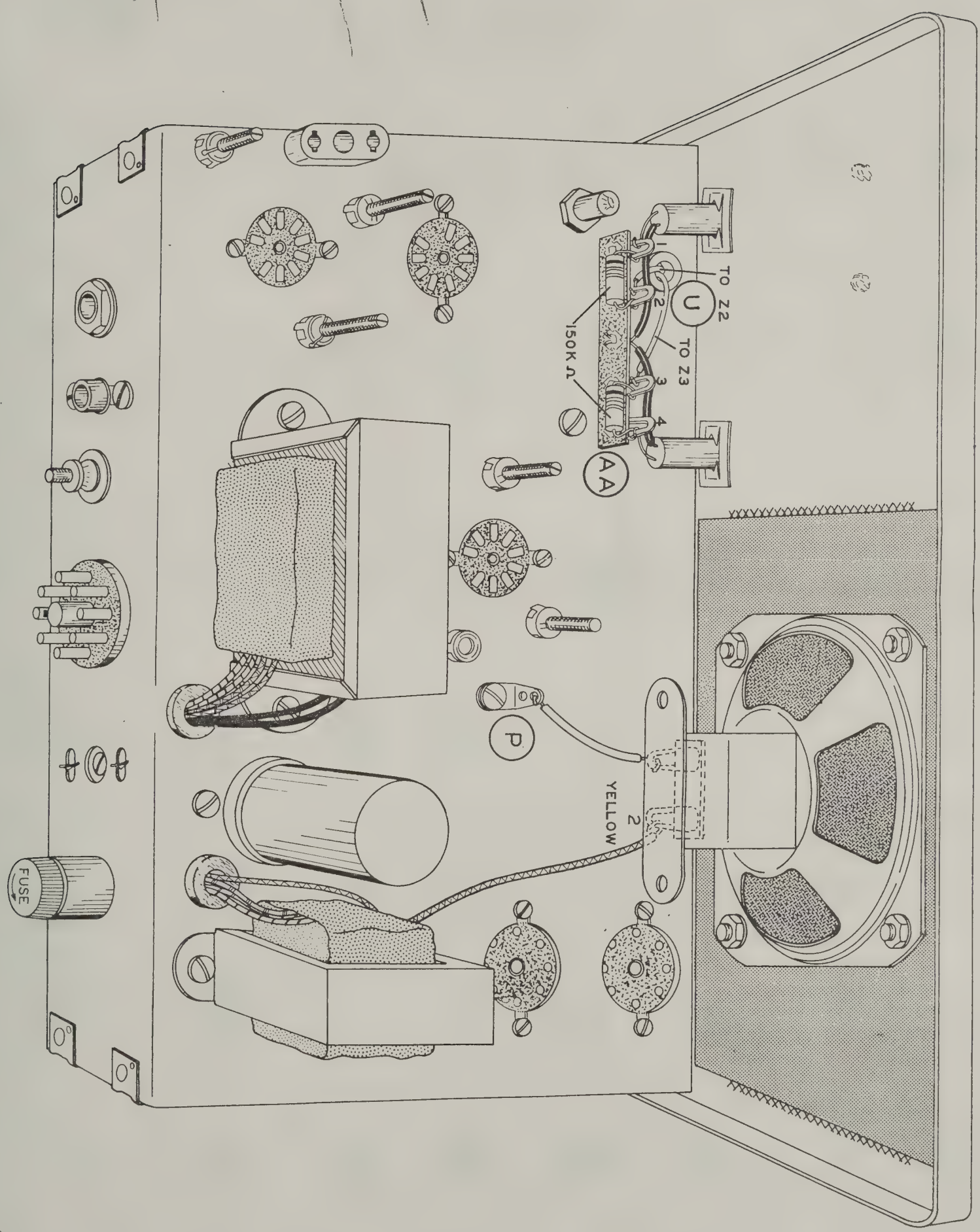


Figure 8

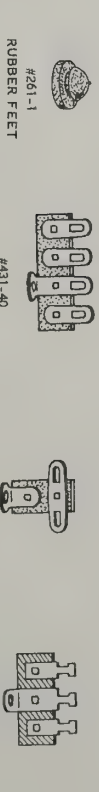
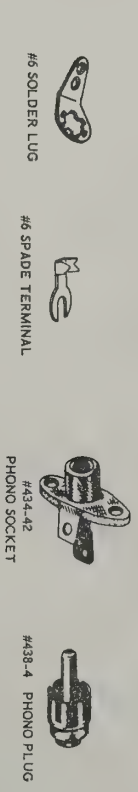
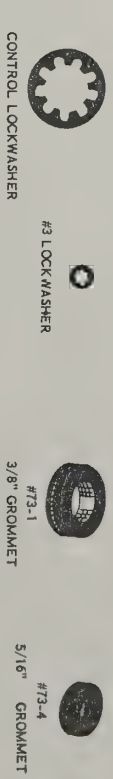
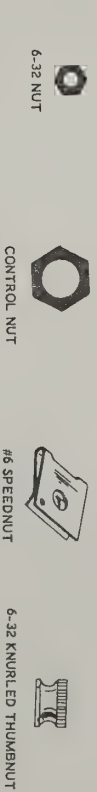
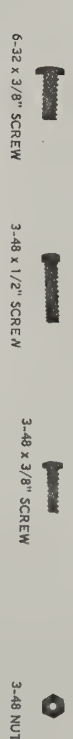
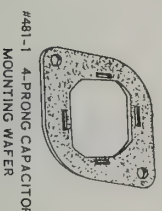
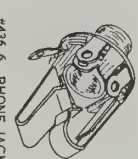
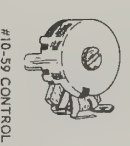
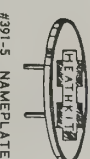
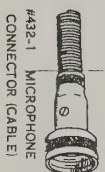
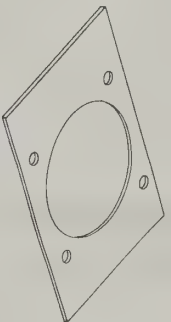
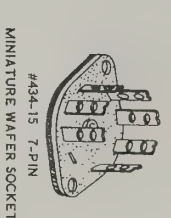
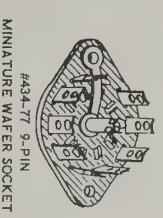
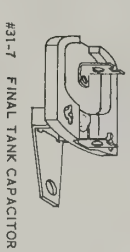
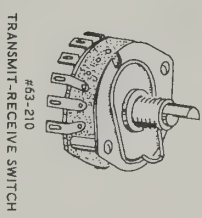
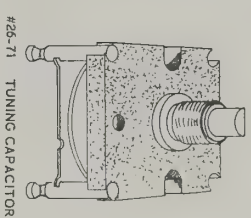
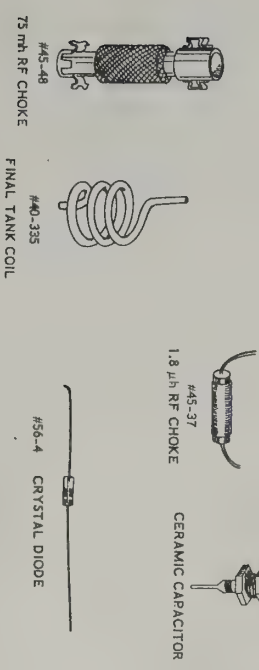
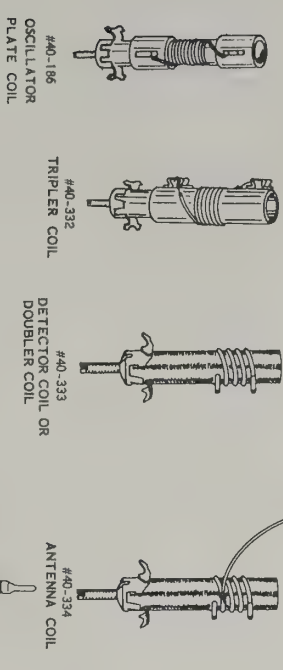


18  
 8060  
 02480  
 8060  
 14506  
 8060  
 29180



Pictorial 11







L2, in the plate circuit of the tripler section V5B should normally be resonated at 72,000 mc. This coil again has considerable range and can be resonated at frequencies from approximately 60 mc to 82 mc. Let us assume this stage is erroneously tuned to 64 mc, where the stage acts as a doubler instead of a tripler.

The coil in the plate circuit of the doubler stage V4A is normally resonated at 144 mc for proper operation. It resonates when the slug is just starting to enter the coil field for reasons of efficiency. This coil can be tuned down to approximately 122 mc. Let us assume the circuit is peaked at 128.00 mc or twice the 64.00 mc signal appearing at the grid circuit. Here the stage is operating in its normal manner as a doubler, but due to improper tuning of previous stages, the output is at the wrong frequency.

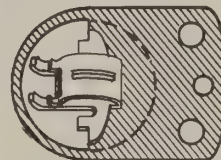
Under these circumstances, almost-normal drive will exist at the final amplifier grid circuit of V4B.

The final tank circuit L4 and C16 will usually tune a range of 125 to 155 mc. This range is only an approximation and will depend upon the characteristics of the individual kit, such as the amount of spacing between the coil turns as outlined in Detail 4C. In view of the above, the output circuit can also be tuned to 128.00 mc. This will allow normal straight-through operation of the final amplifier but **ON THE WRONG FREQUENCY!** The #47 dummy load lamp will light to near normal brilliance, the signal will be clear, crystal controlled, modulate normally and all else will appear normal except minimum final amplifier cathode current will be in the vicinity of 35 ma. Through the above misadjustment, the transmitter output is at 16 times the crystal frequency instead of 18. Although this is the most predominant case, it is not the only instance in which improper output can be obtained. For this reason, complete the following steps **EXACTLY!** An accurate grid dip meter is very handy, if available, and should be used in the diode position. Any grid dipping should be done with all tubes installed and filaments lit. The grid dipper is used as a loosely coupled absorption device rather than as an oscillator.

### TRANSMITTER ADJUSTMENT

Refer to Figure 8 for the following steps.

- (✓) Install a crystal in the crystal socket. Use one whose fundamental frequency is from 8,000 mc to 8,222 mc. War surplus crystals (in FT-241 or FT-243 holders) are ideal.
- (✓) Plug the #47 dummy load lamp into the antenna jack.
- (✓) Set the final tank circuit tuning capacitor to minimum capacity as shown below.



MINIMUM CAPACITY

- (✓) Preset the 24 mc oscillator plate circuit coil L1 such that the end of the threaded brass shaft extends approximately 9/16" above the chassis.
- (✓) Preset the tripler plate coil L2 for minimum inductance (from the top of the chassis). Do this by turning the coil adjustment screw counterclockwise until it will no longer turn freely.
- (✓) In the same manner as above, preset the doubler coil L3 for minimum inductance.
- (✓) Turn the unit OFF and connect one lead of a vacuum tube voltmeter or 20,000  $\Omega$ /volt multimeter to the chassis ground post. Connect the other lead to pin 2 of tube socket V4 using care to avoid any possibility of a short circuit to other wiring or components. If necessary, temporarily solder a small length of wire to pin 2 to make it accessible. The DC voltage read at this point will be negative with respect to chassis ground and at least several volts in magnitude. The actual peak value will depend upon other circuit tuning.

NOTE: In the following tune-up, excessive plate dissipation will occur in tubes V4 and V5 until proper alignment has been accomplished. It is suggested that during initial alignment the TRANS-RCV switch be placed in the TRANS POSITION FOR BRIEF PERIODS ONLY.

- (✓) With the TRANSMIT-RECEIVE switch placed in the RCV position, and all leads clear to avoid a short circuit, turn the unit on. A small amount of negative (-) DC voltage may be indicated on the meter due to "contact potentials," even though the unit is in the receive position.
- (✓) Turn the TRANSMIT-RECEIVE switch to TRANS and adjust the oscillator plate coil L1 for maximum negative DC voltage. This adjustment should be within two or three turns either way from the preset position. If this is not the case and maximum voltage occurs at one of the extreme positions of the slug, recheck the alignment procedure and circuit wiring. This could mean that the coil is tuned to either 16 or 32 mc instead of 24 mc. Turn the unit OFF and remove the meter lead from pin 2 of tube socket V4.
- (✓) Set the meter to a range to read a positive 250 volts DC or more and connect the (+) lead to pin 8 of tube V4. Use care to avoid short circuit to other wiring.
- (✓) With the TRANSMIT-RECEIVE switch in the RCV position, turn the unit on. The voltage at this point (during receive) should read approximately positive 250 volts. Momentarily place the TRANSMIT-RECEIVE switch in TRANS position. The voltage should now read approximately 135-160 volts. Now adjust the tripler plate circuit coil L2 for maximum positive DC voltage as indicated on the meter. Several minor peaks may exist, but there will be one rather pronounced peak which will cause the screen voltage to increase by 15 or 20 volts. A typical adjustment setting for this coil will extend the end of the threaded brass shaft approximately 11/16" above the chassis.
- (✓) Leave the meter connections at the same points. Again momentarily place the TRANSMIT-RECEIVE switch in TRANS and adjust the doubler plate coil L3 for maximum indicated DC voltage. This adjustment should cause approximately an additional several volt rise in screen voltage and should be a slight peak. If more than one slight peak should exist, the correct one is the first one encountered as the slug is turned clockwise into the coil from its preset position. Correct adjustment of this coil

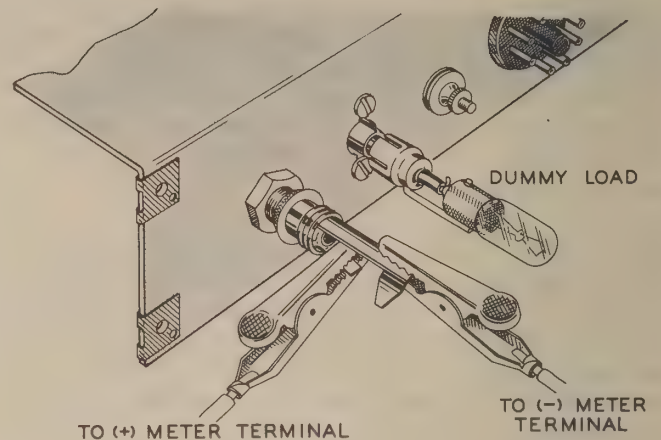


Figure 9

will typically result in an approximate shaft-height-above-chassis length of 11/16". If this peak is not perceptible at this time, preset L3 to A shaft height-above-chassis setting of 11/16" and proceed with further alignment as outlined.

- (✓) Turn the unit off and remove the meter leads. Remove the extension lead from pin 8 of V4 if such was required.
- (✓) Turn the unit on once more. At this time it should be possible to cause the dummy load lamp to light by tuning the final tank circuit to resonance. This adjustment should be made using an insulated screwdriver, since B+ is present on the capacitor adjustment tab. Slowly rotate the final tank circuit capacitor C16, in either direction. In one complete turn of this capacitor, there should be two positions where the lamp will light. Either one is correct providing previous circuits have been tuned properly. Adjust the capacitor at one of these points for maximum brightness of the bulb.

#### FINAL TEST AND ADJUSTMENT

- (✓) Turn the unit OFF and insert the phone plug all the way into the METER JACK on the rear chassis apron. Refer to Figure 9 and connect a DC milliammeter capable of reading 50 ma (milliamperes) DC to the phone plug. Short lengths of hookup wire may be used, if your meter has no leads.

- ✓ Turn the unit to the TRANSMIT position and turn the power switch on. As the unit warms up, the meter reading will slowly climb and come to rest in the vicinity of 18-25 ma. Now adjust the oscillator plate circuit coil L1, the tripler coil L2, and the doubler coil L3 for minimum final amplifier cathode current. Adjustment of L3 will produce a very shallow dip. If this meter reading appreciably exceeds 28 ma, it may be an indication of improper tune-up of the driver stages and should be checked with a grid dip meter if available. Now, turn the unit off. For normal use, the meter plug cannot be left in this fully inserted position. This is due to the switching action of the meter jack, since it overrides the normal function of the TRANSMIT-RECEIVE switch.

- ✓ Withdraw the phone plug part way out of the METER JACK to position A, so that the tip of the plug contacts ONLY the first terminal when it enters the jack. Make certain the tip of the phone plug does NOT also contact the second terminal. In this position the meter indicates rectified RF voltage at the input to the transmission line (or dummy load in this case). Connecting the meter to the phone plug, as was done before, set the range of the meter to indicate 20 volts DC or more. See Figure 10.

- ✓ Turn the unit on and place the TRANSMIT-RECEIVE switch in the TRANS position. After allowing sufficient time for complete warm-up, adjust the final tank circuit capacitor C16, for maximum rectified RF voltage. This should be approximately 12-16 V DC with a 20,000  $\Omega$ /volt meter. An output reading appreciably less than this may be a good indication of improper tune-up, particularly if the final amplifier cathode current exceeds 28 milliamperes at resonance. It would be well to compare the typical shaft-height-above chassis coil settings and if possible, check the final amplifier output frequency with a grid dipper or absorption wavemeter.

- ✓ Attach the microphone to the front panel connector. With the unit in the TRANS position, talking in the microphone should cause the dummy load to glow brighter and the meter reading to increase by several volts. Slight readjustment of the doubler coil L3 may be necessary if this does not happen.

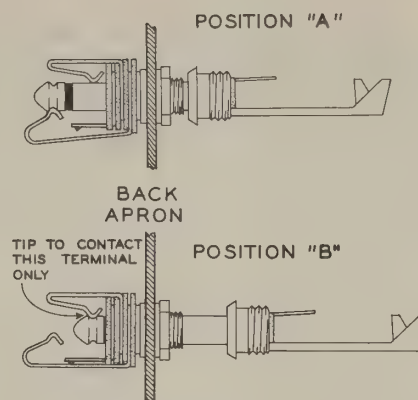


Figure 10

It should be pointed out that the meter and plug can be left in this position during normal use of the unit as an indicator of RF output. The presence of the meter has negligible effect on performance, in either transmit or receive, and it provides an excellent means for tuning with the actual antenna system.

### RECEIVE SECTION ALIGNMENT

Alignment of the receiver is a very simple matter if you have an accurate signal generator or grid dipper. As kit builders frequently have only limited equipment, two methods will be suggested here, and you may take your choice depending upon the equipment you have at hand.

- ✓ Regardless of method used, preset the two receiver coils to the following shaft height above chassis settings:

|                  |       |
|------------------|-------|
| Antenna coil L5  | 9/16" |
| Detector coil L6 | 1/2"  |

See Figure 8.

### METHOD 1:

If an accurate signal generator or grid dipper that tunes to 146 mc is available it should be used. A generator that tunes to a fairly high sub-multiplier ( $1/2$ ,  $1/3$ , etc.) of 146 mc is also sufficient for this method.

The harmonic content of an average signal generator used at a sub-harmonic will normally be sufficient to allow alignment of the receiver. A generator of lower frequency output than those indicated above would not be desirable since it would be difficult to determine which harmonic the receiver is tuned to.

- (✓) The regeneration control on the rear chassis apron should be sufficiently advanced in the clockwise direction to cause the detector to go into regeneration. This is indicated by a distinct "hissing" or "rushing" sound. If the detector should drop out of oscillation and remain so during alignment, it will be necessary to advance the control further.
- (✓) Connect the signal generator set to 146 mc to the antenna input. If the generator has clip leads, connect the generator shield or ground lead to the rear apron ground post. Connect the "hot" lead to the wire running between the TRANSMIT-RECEIVE switch and the antenna jack. If a grid dipper should be employed, set the frequency to 146 mc and position the dipper coil so that for initial alignment it is approximately 6" from the receiver. At this distance, radiation from a dipper used in the CW (carrier on) condition should be sufficient for calibration purposes.
- (✓) With the receiver operating, set the tuning knob pointer vertical (146 mc) and adjust the detector coil L6 to receive the signal. This is indicated by maximum quieting in the receiver. This adjustment should be within several turns of its preset position.
- (✓) Now rotate the receiver tuning capacitor knob from one extreme to the other, making certain the detector remains in regeneration at both extremes. Also make sure that the received signal (from generator or grid dipper) is centered at the 146 mc point.
- (✓) Leave the generator frequency set at 146 mc and decrease the generator output to the point where the signal is just barely receivable. This will be in the vicinity of 1 microvolt fundamental frequency on a calibrated generator. Now adjust the antenna coil L5 for maximum gain of the RF amplifier, as indicated by maximum quieting in the detector. This adjustment may change the frequency of the detector slightly, so it should be checked and retuned if necessary. The proper setting of this coil will be within several turns of the preset position. The peak will be rather broad in nature, although a definite increase in gain will be noted as the coil is tuned near 146 mc resonance.

- (✓) Recheck the adjustments of the detector coil L6 for calibration, the antenna coil L5 for gain and the regeneration control R11 for maximum sensitivity. With the two coils properly adjusted, set the regeneration control to the minimum clockwise position, at which the receiver will remain in regeneration over the entire tuning range and always start when the unit is turned on.

#### METHOD 2 - AN-ON-THE-AIR SIGNAL

- ( ) With a suitable antenna connected (see antenna section, Page 37), have a friend, preferably at a distance of 10 miles or so, (depending upon his station equipment and your antenna) transmit a test signal for you.
- ( ) Set the receive tuning knob to indicate his approximate known frequency. Now adjust the detector coil L6 to receive his signal. This adjustment should be within several turns of the preset position.
- ( ) After dial calibration has been established, adjust the antenna coil L5 and the rear apron regeneration control R11 for maximum sensitivity of the receiver. This is best indicated by maximum quieting rather than loudest signal since the detector provides effective automatic volume control action above 3 microvolt input. If the on-the-air signal produces complete quieting, attempt to reduce the signal input to the receiver, by rotating either antenna system. Final adjustment of the receiver should be done with a very weak signal, one just barely audible. Simultaneously adjust L5 for calibration and L6 and R11 for sensitivity.
- ( ) Some readjustment of the transmitter final tank capacitor, C16, will normally be required when the transceiver is loaded into a typical antenna system, after which the cabinet may be installed and secured with four 6-32 x 3/8" screws. This final adjustment of C16 is for maximum voltage on the transmission line indicated on an external DC voltmeter plugged into the first position of the meter jack. For a properly matched antenna and transmission line, maximum voltage indicates maximum power output.

NOTE: The small card holder on the end of the cabinet may be used to display your license or a copy of it. Your call letters, operating frequency, net information, etc.

## TYPES OF ANTENNAS

Various types of antenna designs exist which differ in complexity, directional characteristics, polarization and cost. The simplest of the horizontally polarized type is shown in Figure 11, and is generally referred to as a "dipole" or "doublet." Its directional characteristics are not very pronounced and represent an approximate "figure eight" pattern. The antenna as shown is properly fed with 75  $\Omega$  ribbon line (special twin lead), although doublets are frequently fed with 75  $\Omega$  coax with good results.

Simple, practical antennas for vertical polarization are the "ground plane" and "coaxial" types, either of which is essentially omni-directional, that is, they radiate equally well in all directions in the horizontal plane.

The choice of polarization is largely a sectional one. Some areas are predominately horizontal where others are vertical and it is suggested you use the polarization generally in use in your area. Beam antennas will provide typical effective radiated power gains up to 50 or 60, depending upon the number of parasitic elements used.

This means in effect that both transmitted and received signals will be up to 50 to 60 times

stronger in signal strength (in the direction of maximum radiation) than when a simple doublet is used.

In viewing Figure 12, it is apparent that some means of turning the antenna is required unless point-to-point communication is the only requirement. Most any of the inexpensive television antenna rotors are adequate for a single bay beam of reasonable length on 2-meters.

The choice of a directional antenna versus an omni-directional one is largely dependent upon application. Where strong signals are consistently present or where it is undesirable to have to rotate the antenna, the simpler types of antennas lend themselves readily. The highly directional arrays find good application in weak signal communications, point-to-point communications, or where it is desirable to reject signals from other interfering stations by rotating the antenna.

There are numerous other antenna systems available for these frequencies. Among many others, excellent references on the subject appear in VHF HANDBOOK by Orr and Johnson; THE RADIO AMATEUR'S HANDBOOK published by The American Radio Relay League or the more popular monthly periodicals.

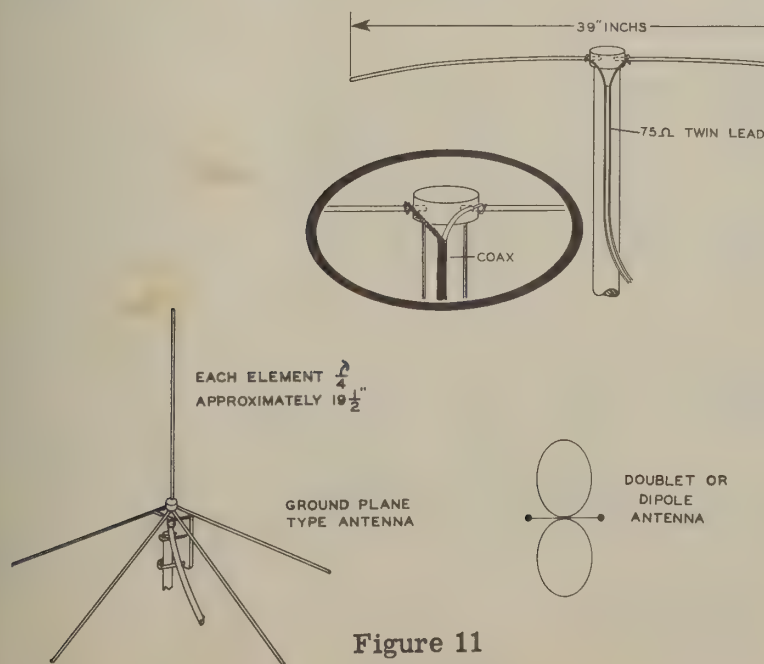


Figure 11

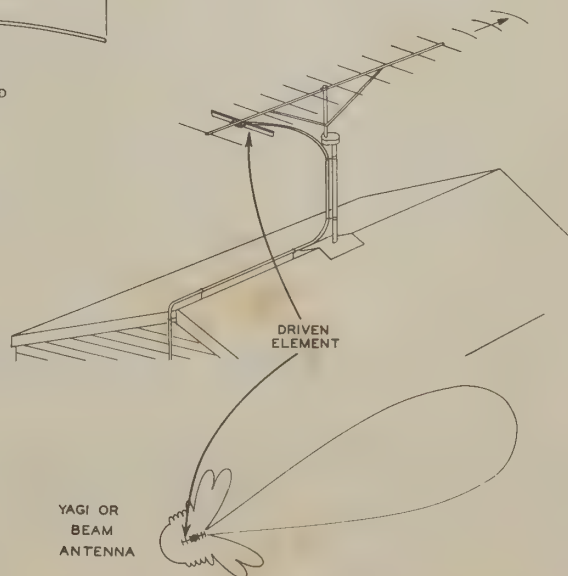


Figure 12

## ANTENNA FEED OR MATCHING SYSTEM

The antenna connector on your "Twoer" is designed for an unbalanced transmission line of 50-75 ohms (coaxial cable). Frequently antenna systems are designed to be fed with 300  $\Omega$  twin lead or "ladder lines." A simple balun system shown in Figure 13 or Figure 13A, will provide the conversion from a 75  $\Omega$  unbalanced to 300  $\Omega$  balanced line and may be used at either end of the transmission line.

For normally short runs of transmission line, either coax or twin lead may be used. For long runs, coax will have considerably more loss than twin lead or ladder line. If twin lead transmission line is used to the antenna, the coil type balun (Figure 13A) will work well. If the balun is used at the antenna (using coax as the transmission line), the coaxial balun (Figure 13) is preferred due to its exposure to outdoor conditions.

Figure 13B is a schematic view of a balun coil.

For experimental purposes only, certain types of television antennas will work to a fair degree at 144 mc. The notable one in this category is a conical type in which case the coil balun would be used to feed the 300  $\Omega$  TV twin lead to the antenna. In general, most TV antennas will NOT perform well on two meters.

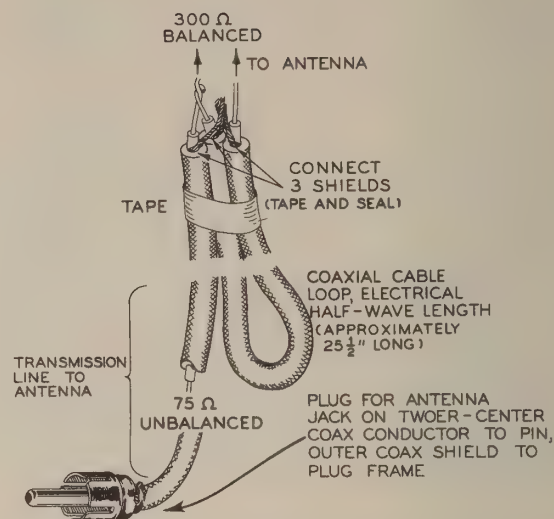


Figure 13

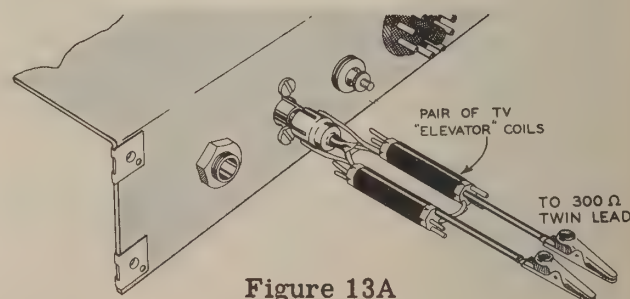


Figure 13A

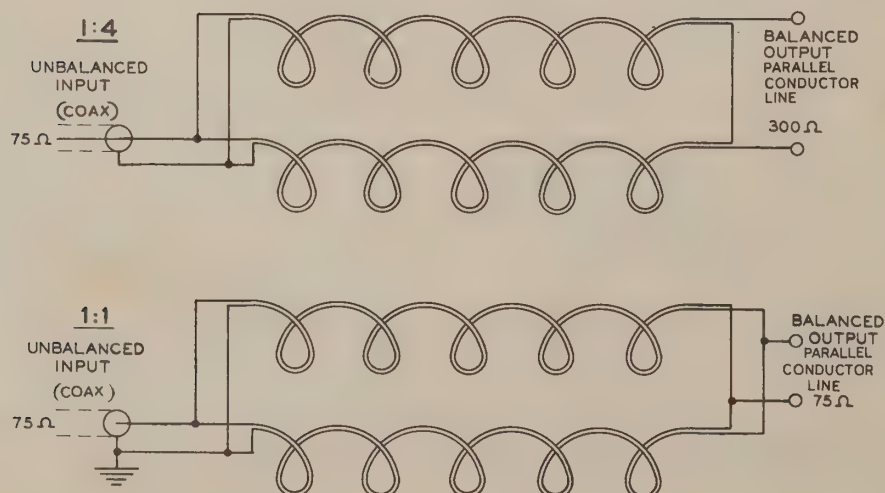


Figure 13B

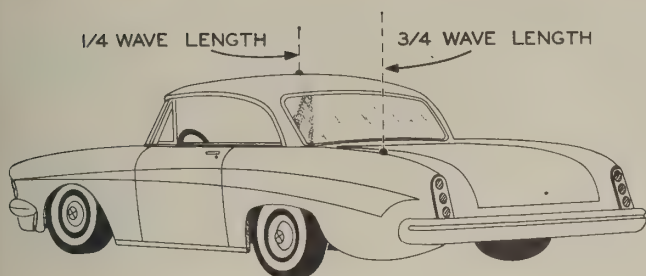


Figure 14

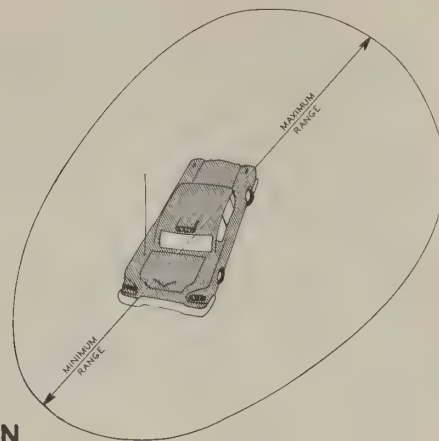


Figure 15

## INSTALLATION INFORMATION

Various factors should be considered before your HW-30 is installed at a fixed location. Several of these factors are listed below.

The polarization of the antenna system (the relative direction of the radiating elements) is quite important at the VHF frequencies. The majority of amateurs on 2-meter have horizontally polarized antennas; that is, the radiating element or elements are parallel to the surface of the earth. It should be pointed out that, even at short ranges it is usually difficult to communicate between two stations, if one is horizontally polarized and the other polarized vertically. Most horizontally polarized antennas show directional properties; that is, they will transmit and receive a stronger signal in one or more directions than in others. It is suggested that you use the polarization in general use in your area.

Non-directional, vertically polarized antennas frequently find application in fixed-to-mobile unit operation where the mobile units location is not predictable.

Try to locate your HW-30 near a good earth ground, such as a water pipe going directly underground. Although the use of an earth ground is not essential for proper operation of your HW-30, in many instances greatly improved operation will result, and it is considered good practice to have the system grounded.

### INSTALLATION AT A MOBILE LOCATION

The section to follow will deal specifically with installation in an automobile or light truck, but the majority of this information is also applicable to other mobile installations (boats, etc.). See Figures 14 and 15.

In a mobile installation, the antenna system is of great importance. Any mobile system is at a decided disadvantage, due to the lack of a good earth ground, the only ground being the capacitive coupling between the vehicle body and the earth below.

With few exceptions, the antenna best suited for mobile service will be either some sort of vertically polarized whip antenna (Figure 14) or the current "halo" antenna for horizontal polarization. It is suggested that you contact hams in your area to determine the type of polarization used in your locality since some areas prefer one over the other and it becomes very difficult to maintain communication under cross-polarization conditions at this frequency. For vertical polarization, a 1/4 wave (approximately 19") or 3/4 wave (approximately 57") whip, suitably placed, as shown in Figure 14, is generally the most practical. These antennas use the metal vehicle body as their "ground plane" and for this reason are normally somewhat directional when installed in a more practical location, such as the rear of the vehicle. If installed in the roof center, radiation is usually better and very little directional properties will be noted. No specific information about the actual directional characteristics of any given installation can be given here due to variables in antenna location, but a typical installation might be expected to yield a radiation pattern similar to that shown in Figure 15.

This directional characteristic normally causes no serious difficulty, but you should be aware of its existence.

In nearly all mobile installations, the ambient noise level will be higher than at a fixed location. For this reason, serious consideration should

be given to the physical position of the unit with respect to the operator. Obviously, only those locations within easy reach of the operator should be considered, but usually in any given situation more than one such location exists. Try to pick the location which offers the best compromise of these requirements.

After this location has been chosen, the unit should be securely fastened to some solid surface. Simple sheet metal brackets, fashioned to fit your particular requirements, should suffice.

Engine ignition interference may be a problem. Actual field tests in a variety of vehicles have indicated no suppression is required (in the average vehicle) beyond that normally provided for a vehicle with a "factory equipped" standard broadcast band radio receiver. If an ignition interference problem is present, nearly any radio service shop, skilled in auto radio repair, should be able to help you locate and correct the difficulty. One possible cause of such interference can be the exhaust system. The muffler

and tail pipe are frequently mounted with rubber insulated mounting clamps to reduce vibration, and thus the muffler and tail pipe are electrically grounded at the engine end only. This problem is more likely to be present if a bumper mount type antenna is employed, and can usually be solved by electrically grounding the tail pipe to the vehicle frame at one or more points. Many other possibilities could be mentioned here, but the many variables between vehicles and installations make this somewhat impractical.

Generator interference may also be a problem as evidenced by a generator "whine". It is recommended in these cases a coaxial capacitor of .5  $\mu$ fd value with a current rating exceeding the generator output (similar to Sprague 48P18 rated at 40 amperes) be used to replace the usual bypass capacitor. The insertion of a coaxial capacitor in the armature winding lead will require a short additional connecting lead of #10 gauge wire. The capacitor case is grounded using the same screw which held the old capacitor in place.

### IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, malfunction due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as illustrated in the Figures found in the SOLDERING TECHNIQUES section of this manual.
3. Check to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly.
4. Check the tubes with a tube tester or by substitution of tubes of the same types and known to be good.
5. Check the values of the component parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
6. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring beneath the chassis.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram. NOTE: All voltage readings were taken with a HEATH-KIT® Vacuum Tube Voltmeter. Voltages may vary 10% due to line voltage variations.
8. Listed on the following page are some possible difficulties which might arise in the construction and operation of your HW-30 Transceiver. The suggested corrective measures given definitely DO NOT RULE OUT all other possibilities, but are given primarily to direct your attention to the areas most likely to be faulty.

## TROUBLESHOOTING CHART

|                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Receiver section dead.                                                                  | <ul style="list-style-type: none"> <li>a. Faulty tubes - check V1, V2 and V3 voltages.</li> <li>b. Wiring error - recheck wiring.</li> <li>c. Faulty speaker or speaker ground - check speaker voice coil.</li> </ul>                                                                                                                                                                                                                                                                                                                        |
| 2. Receiver section weak.                                                                  | <ul style="list-style-type: none"> <li>a. Faulty tube - check V1, V2 and V3 voltages.</li> <li>b. Regeneration control not sufficiently advanced.</li> <li>c. RF or detector coils misaligned.</li> <li>d. Faulty antenna or connecting cable.</li> </ul>                                                                                                                                                                                                                                                                                    |
| 3. Transmitter appears dead.                                                               | <ul style="list-style-type: none"> <li>a. Faulty tubes - check V4 and V5 voltages.</li> <li>b. Wiring error - recheck wiring.</li> <li>c. Transmitter section coils mistuned - recheck tuning.</li> <li>d. Dummy load shorted or open - recheck.</li> <li>e. Antenna mismatch - recheck antenna installation.</li> </ul>                                                                                                                                                                                                                     |
| 4. Power input to final amplifier too high (over 6 watts), or too low (less than 4 watts). | <ul style="list-style-type: none"> <li>a. Faulty tube - check V4 and V5 voltages.</li> <li>b. Wiring error - recheck wiring.</li> <li>c. Transmitter section misaligned - recheck tuning procedure.</li> <li>d. Faulty meters - recheck meter readings.</li> <li>e. High or low activity crystal - substitute another crystal for comparison check.</li> <li>f. B+ voltage too high or low - check power supply voltages. Check for leaky capacitors, open or shorted resistors, at the power supply. Check transformer voltages.</li> </ul> |
| 5. Strong signal from transmitter but no modulation.                                       | <ul style="list-style-type: none"> <li>a. Faulty microphone or connections - recheck.</li> <li>b. Faulty tubes - check V1 and V2 voltages.</li> <li>c. Wiring error - recheck V2 and V2 wiring.</li> <li>d. Shorted RFC6 to ground at mike connector - center in connector opening.</li> </ul>                                                                                                                                                                                                                                               |
| 6. Weak transmitted signal.                                                                | <ul style="list-style-type: none"> <li>a. Faulty antenna - check.</li> <li>b. Shorted or open connecting cable - check.</li> <li>c. Poor antenna location.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                        |
| 7. Low power supply voltages.                                                              | <ul style="list-style-type: none"> <li>a. Low line voltage - check.</li> <li>b. Leaky filter capacitors - check.</li> <li>c. Error in dropping resistor values or wiring - check.</li> <li>d. Faulty transformer - check voltages.</li> </ul>                                                                                                                                                                                                                                                                                                |
| 8. Modulation hum.                                                                         | <ul style="list-style-type: none"> <li>a. Power supply filter capacitor ground connection ungrounded - resolder.</li> <li>b. Faulty tubes - check V1 and V2.</li> <li>c. Open grid circuit connection - check wiring and soldering of V1 and V2.</li> </ul>                                                                                                                                                                                                                                                                                  |
| 9. Cathode current of final amplifier higher than normal.                                  | <ul style="list-style-type: none"> <li>a. Check the tuning of all transmitter coils for proper resonance and alignment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                           |

## SERVICE INFORMATION

SERVICE

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT® equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT® equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under "IN CASE OF DIFFICULTY." Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under "IN CASE OF DIFFICULTY." Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available.
5. Print or type your name and address, preferably in two places on the letter.

With this information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. He will make no incorrect assumptions nor waste time checking files for the correct spelling of name and address. (The automatic letter opener sometimes cuts through the letter, hence the suggestion to print the name and address twice.) In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument (including all connecting cables) to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a fixed fee of \$8.00, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT® Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT® equipment. Although you may find charges for local service somewhat higher than those listed in HEATHKIT® manuals (for factory service), the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT® Service Centers will honor the regular 90 day HEATHKIT® Parts Warranty on all kits, whether purchased through a dealer

or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT<sup>®</sup> equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT<sup>®</sup> dealer in order to be eligible for parts replacement under the terms of the Warranty.

**THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL.** Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT<sup>®</sup> equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

## REPLACEMENTS

Material supplied with HEATHKIT<sup>®</sup> products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

- A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.
- B. Identify the type and model number of kit in which it is used.
- C. Mention date of purchase.
- D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. **PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO.** Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

## SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Be sure to include all tubes, the microphone, the power cord, the crystal that you plan to use, and the cabinet.

**ATTACH A TAG TO THE EQUIPMENT BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED.** Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows: **To: HEATH COMPANY Benton Harbor, Michigan'**

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

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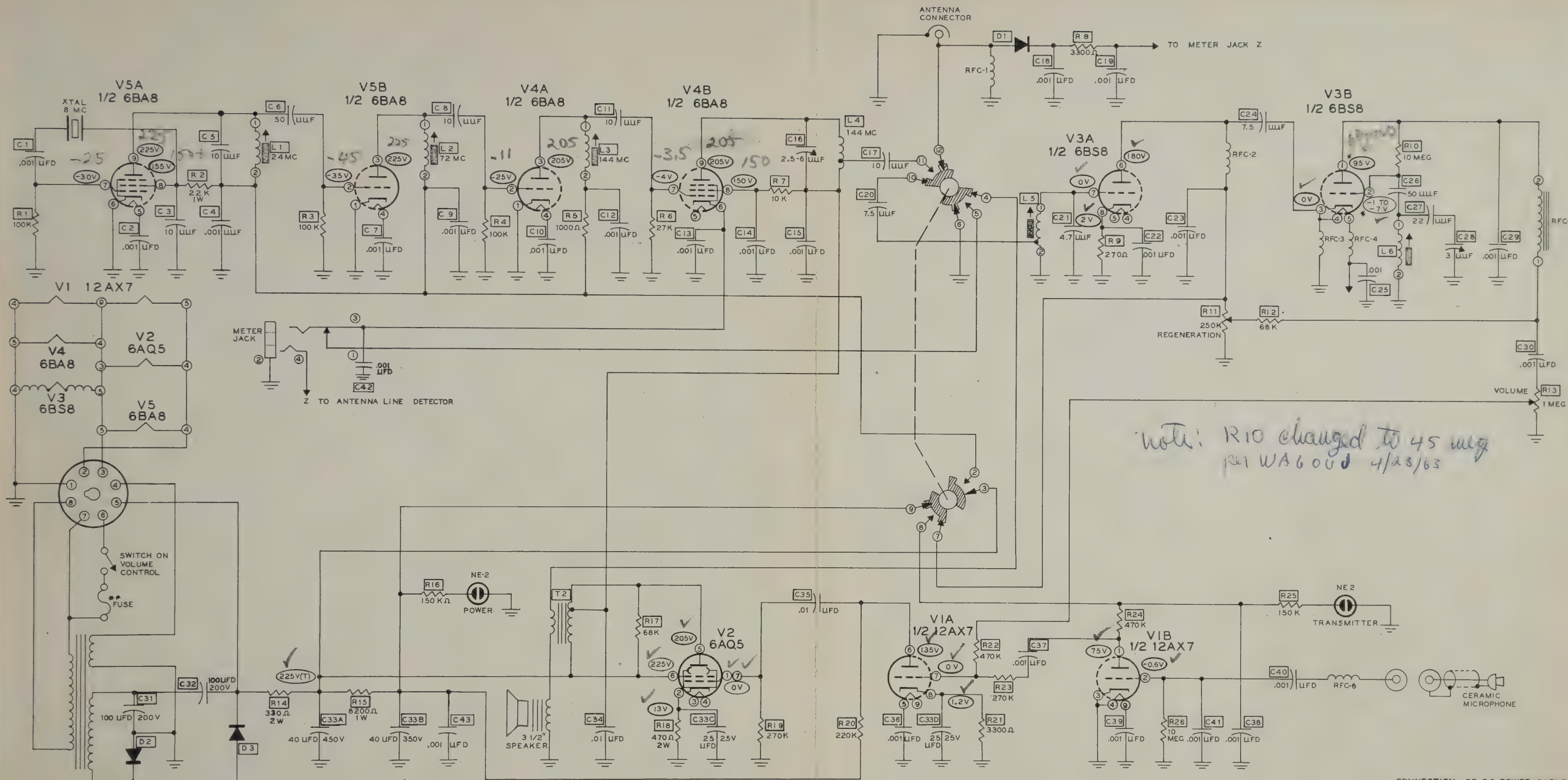
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HEATHKIT® Service Centers will honor the regular 90 day HEATHKIT® Parts Warranty on all kits, whether purchased through a dealer



# NOTE:

ALL RESISTANCES IN OHMS K = 1000.  
 ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.  
 ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS GROUND.  
 VOLTAGES TAKEN WITH AN 11 MEGOHM VTVM.  
 ALL VOLTAGES POSITIVE UNLESS OTHERWISE SPECIFIED.

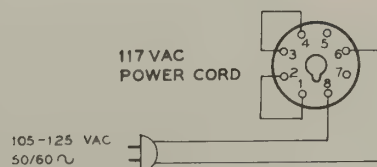
VOLTAGE READINGS TAKEN WITH UNIT OPERATING FROM NOMINAL 117 VOLT AC LINE WITH DUMMY LOAD PLUGGED IN AND CONTROLS SET AS FOLLOWS:  
 VOLUME CONTROL - ANY POSITION - ON  
 TUNING CAPACITOR - ANY POSITION  
 REGENERATION - ADJUSTED FOR NORMAL RECEPTION  
 MICROPHONE - DISCONNECTED

READINGS ON V1, V2, V4 AND V5 WITH SWITCH IN TRANSMIT.  
 READINGS ON V3 WITH SWITCH IN RECEIVE.

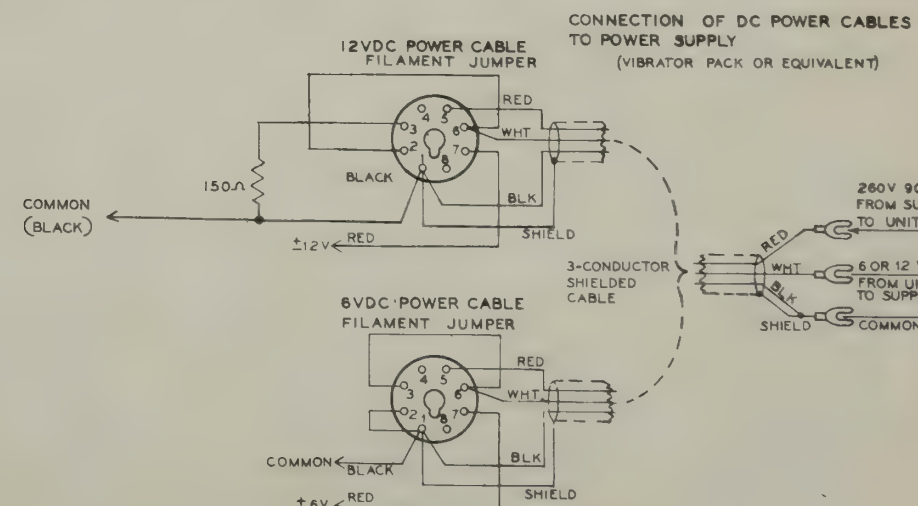
PRESENCE OF METER PROBE IN TRANSMITTER SECTION WILL CAUSE DE-TUNING IN MANY CASES. VALUES SHOWN ARE APPROXIMATE ONLY AND DEPENDENT UPON TUNING AND CRYSTAL ACTIVITY.

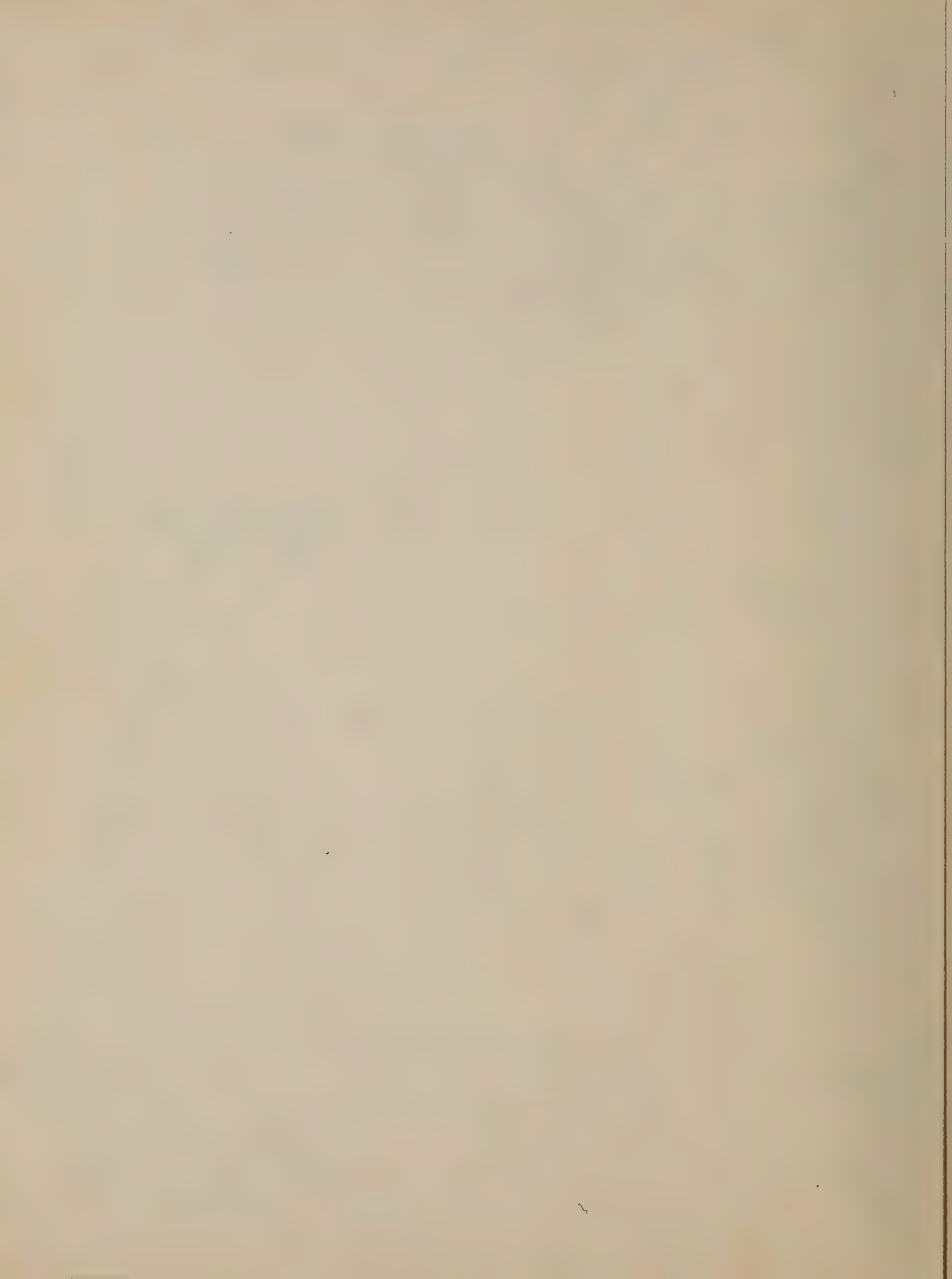
\* VARIES WITH TUNING AND R11 SETTING.

\*\* 1-1/2 AMP FOR AC OPERATION.  
 8 AMP FOR EXTERNAL POWER SUPPLY OPERATION.



## 2 METER AMATEUR TRANSCEIVER MODEL HW-30





## HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

### RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

### ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

### WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

### SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.

|                                     |  |                                                               |  |                                       |  |                                                 |  |
|-------------------------------------|--|---------------------------------------------------------------|--|---------------------------------------|--|-------------------------------------------------|--|
| Antenna<br>General                  |  | Resistor<br>General                                           |  | Neon Bulb                             |  | Receptacle<br>two-conductor                     |  |
| Loop                                |  | Resistor<br>Tapped                                            |  | Illuminating<br>Lamp                  |  | Battery                                         |  |
| Ground                              |  | Resistor Variable                                             |  | Switch<br>Single pole<br>Single throw |  | Fuse                                            |  |
| Inductor<br>General                 |  | Potentiometer                                                 |  | Switch<br>double pole<br>single throw |  | Piezoelectric<br>Crystal                        |  |
| Air core<br>Transformer<br>General  |  | Thermistor                                                    |  | Switch<br>Triple pole<br>Double throw |  | 1000 = K                                        |  |
| Adjustable<br>Powdered Iron<br>Core |  | Jack<br>two conductor                                         |  | Switch<br>Multipoint or<br>Rotary     |  | 1,000,000 = M                                   |  |
| Magnetic Core<br>Variable Coupling  |  | Jack<br>three conductor                                       |  | Speaker                               |  | OHM = $\Omega$                                  |  |
| Iron Core<br>Transformer            |  | Wires<br>connected                                            |  | Rectifier                             |  | Microfarad = MF                                 |  |
| Capacitor<br>General                |  | Wires<br>Crossing but<br>not connected                        |  | Microphone                            |  | Micro<br>Microfarad = MMF                       |  |
| Capacitor<br>Electrolytic           |  | A. Ammeter<br>V. Voltmeter                                    |  | Typical tube symbol                   |  | Binding post                                    |  |
| Capacitor<br>Variable               |  | G. Galvanometer<br>mA. Milliammeter<br>uA. Microammeter, etc. |  |                                       |  | Terminal strip                                  |  |
|                                     |  |                                                               |  |                                       |  | Wiring between<br>like letters is<br>understood |  |

## WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY

## BIBLIOGRAPHY

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ARRL ANTENNA BOOK  
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fornia).

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lations (bulletin #M1544) Electric Auto-Lite  
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VHF HANDBOOK by Orr and Johnson.

## HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

### RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

### ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

### WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.


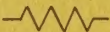

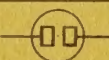

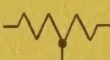



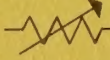





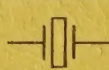

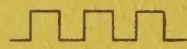
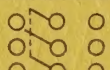

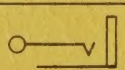


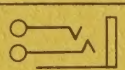


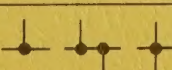


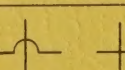



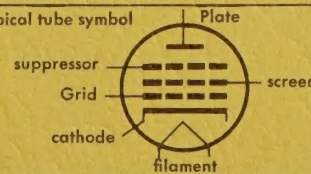
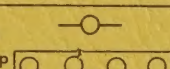


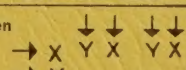
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

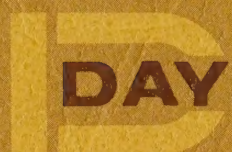
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|                                     |                                                                                     |                                                               |                                                                                     |                                                                                                             |                                                                                       |                                                 |                                                                                       |
|-------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------|
| Antenna<br>General                  |  | Resistor<br>General                                           |  | Neon Bulb                                                                                                   |   | Receptacle<br>two-conductor                     |  |
| Loop                                |  | Resistor<br>Tapped                                            |  | Illuminating<br>Lamp                                                                                        |   | Battery                                         |  |
| Ground                              |  | Resistor Variable                                             |  | Switch<br>Single pole<br>Single throw                                                                       |   | Fuse                                            |  |
| Inductor<br>General                 |  | Potentiometer                                                 |  | Switch<br>double pole<br>single throw                                                                       |   | Piezoelectric<br>Crystal                        |  |
| Air core<br>Transformer<br>General  |  | Thermistor                                                    |  | Switch<br>Triple pole<br>Double throw                                                                       |   | 1000 =                                          | K                                                                                     |
| Adjustable<br>Powdered Iron<br>Core |  | Jack<br>two conductor                                         |  | Switch<br>Multipoint or<br>Rotary                                                                           |   | 1,000,000 =                                     | M                                                                                     |
| Magnetic Core<br>Variable Coupling  |  | Jack<br>three conductor                                       |  | Speaker                                                                                                     |   | OHM =                                           | $\Omega$                                                                              |
| Iron Core<br>Transformer            |  | Wires<br>connected                                            |  | Rectifier                                                                                                   |   | Microfarad =                                    | MF                                                                                    |
| Capacitor<br>General                |  | Wires<br>Crossing but<br>not connected                        |  | Microphone                                                                                                  |  | Micro<br>Microfarad =                           | MMF                                                                                   |
| Capacitor<br>Electrolytic           |  | A. Ammeter<br>V. Voltmeter                                    |  | Typical tube symbol<br> |                                                                                       | Binding post<br>Terminal strip                  |  |
| Capacitor<br>Variable               |  | G. Galvanometer<br>MA. Milliammeter<br>uA. Microammeter, etc. |  |                                                                                                             |                                                                                       | Wiring between<br>like letters is<br>understood |  |

**HEATH COMPANY**

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